

A PARTIAL SYNOPSIS OF THE FISHES OF THE FRESH
WATERS OF NORTH CAROLINA.

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Read before the Amer. Philosophical Society, June 7, 1870.

The material on which the present investigation is based was, for the most part, procured by the writer during the autumn of 1869. A journey from the Cumberland Mountains of Tennessee to the ocean, offered opportunity for making collections in the waters of five hydrographic basins, viz. : those of the Cumberland, Tennessee, Catawba, Yadkin and Neuse. The streams of the Tennessee examined were the Clinch and French Broad ; the former in a tributary called Coal Creek, in Anderson Co., Tenn.; the latter at various points, both in the mountainous part of its course, and in the elevated and flat valley of Henderson Co., where it takes its rise. A small seine with fine meshes, kindly lent me by the administration of the Smithsonian Institution, was used in the smaller streams ; and fishermen's apparatuses, especially weir traps, furnished most of the species inhabiting the river channels. Passing many of the latter at the time of year when the migratory fishes were descending, the writer was able to examine and procure them in great numbers. The opportunity of seeing fishes in life, it is believed, is no small aid to their proper specific determination.

ACANTHOPTERYGII.

PERCA, Linn.

1. PERCA FLAVESCENS, Cuv.

Neuse River.

ROCCUS, Gill.

2. ROCCUS LINEATUS, Bloch.

Neuse River.

STIZOSTEDIUM, Raf.

3. STIZOSTEDIUM AMERICANUM, C. V.

This is the largest Percoid of the Western waters, occasionally attaining a weight of 35 lbs.: no specimen of more than 10 lb. came under my observation. It loves the most boisterous and rapid streams, ascending them to near their sources, having much the manners, and haunting the same waters as the trout, but of much more voracious habits. Its swiftness enables it to take the black perch (*Micopterus fasciatus*) with ease, though that fish is, after it, much the most powerful swimmer of the rivers it inhabits. I took two from the stomach of a *Lucioperca* of eight pounds, one of which weighed $2\frac{1}{2}$ lbs. Suckers are used as bait in taking them by hook ; but the mode in which large specimens are most readily taken is by shooting. When the *Lucioperca* has gorged himself, he seeks some shallow bayou, and lies in a sluggish state, digesting his meal. Then

the gun-fisherman, concealed in a tree close by, makes sure of him. It is the most valued food-fish of the French Broad, the flesh being very tender as well as rich.

Without the opercular armature of the Percae, its chief defence is in its numerous and powerful canine teeth, with which it makes serious wounds on the hands of the unwary fisherman. The common name on the French Broad is "Jack."

4. STIZOSTEDIUM SALMONEUM, Raf.

This fine species was described to me as an inhabitant of the French Broad, though I did not see it. As elsewhere, it is called Salmon. A species of this genus occurs also in the Neuse.

ETHEOSTOMA, Raf.

5. ETHEOSTOMA NEVISENSE, Cope.

Proc. Amer. Philos. Soc., 1870, p. 261.

Turbulent waters of the Neuse River.

6. ETHEOSTOMA MACULATUM, Girard.

Putnam Bull. Mus. Comp. Zool., Cambridge, No. I. Cope. Proc. Am. Phil. Soc., 1870, 262. *Hadropterus maculatus*, Girard. Proc. A. N. S., Phil., 1859, 100.

Abundant in the rapid waters of Buck Creek, which empties into the Catawba, in Marion Co., N. Ca.

HYPOHOMUS, Cope.

Cottogaster, Cope, Journ. Acad. Nat. Sci., Phila. 1869, 210, not of Putnam.

The name *Cottogaster*, my friend Prof. Putnam informs me, was applied to species of the type of *Boleosoma*. It is, therefore, inapplicable to the *C. aurantiacus*, to which I apply the above generic name. The characters of the genus have been pointed out as above cited. They are those of *Etheostoma*, excepting the median ventral series of shields, which are here wanting.

7. HYPOHOMUS AURANTIACUS, Cope.

Jour. Acad. Nat. Sci., Phila., 1868, 211.

One specimen from the French Broad River, in Madison Co., North Carolina, measuring 4 inches 8 lines in length, more than twice the size of the types, and larger than any species of the *Etheostomine* group, excepting *Percina caprodes*. Color in life bright yellow, with a black lateral band, and a few brown spots on each side of the dorsal fin.

POECILICTHYS, Agass.

8. POECILICTHYS VITREUS, Cope.

Proceed. Am. Phil. Soc. 1870, 253.

This species is quite translucent in life. The only specimen taken was

adult, and exhibited ovaries well filled with well developed ova. Seven green dorsal spots, and eight or nine linear spots on the sides, of the same color.

Walnut Creek, a tributary of the Neuse River.

9. *POECILICHTHYS FLABELLATUS*, Raf.

Cope, Jour. A. N. Sci., Phil., 1868, 213. *Catonotus*, Agass., Putn. Bull. M. C. Zool., I.

Var. Cope, Proc. Am. Phil. Soc., 1870, 263.

From the Catawba River.

10. *POECILICHTHYS VULNERATUS*, Cope.

Proceed. Am. Phil. Soc., 1870, 266.

A beautiful species from the Warm Springs Creek, Madison Co., N. Ca., a tributary of the French Broad River.

11. *POECILICHTHYS RUFINELINEATUS*, Cope.

Loc. cit., 267.

Abundant in the same localities as the last, and one of the most ornate species of the genus.

12. *POECILICHTHYS ZONALIS*, Cope.

Jour. Acad. Nat. Sci., Phil., 1868, 212, Tab. xxiv., f. 1.

French Broad River.

BOLEOSOMA, DeKay.

Cope, Proc. A. P. Soc., 1870, 268.

13. *BOLEOSOMA EFFULGENS*, Girard.

Cope, l. c. *Artina effulgens*, Girard. Proc. Acad. Nat. Sci., Phil., 1859, 64.

Deep River, Guilford Co., North Carolina, from Samuel C. Collins.

14. *BOLEOSOMA MACULATICEPS*, Cope.

Proc. A. P. Soc., 1870, 269.

Upper waters of the Catawba River.

HYOSTOMA, Agass.

Cope, Jour. A. N. Sci., Phil., 1868, 214.

15. *HYOSTOMA CYMATOGRAMMUM*, Abbott.

French Broad River.

MICROPTERUS, Lac.

Grystes, Cuv. Val.

16. *MICROPTERUS FASCIATUS*, DeKay.

Apparently not found east of the great Water Shed: I only obtained it in the state in the French Broad. Also from the Clinch and the Cumberland.

17. MICROPTERUS NIGRICANS, Cuv.

The green bass is abundant in all the rivers of the State. I have it from the Neuse, Yadkin, Catawba, upper and lower French Broad, and from the Clinch in Tennessee. Specimens from the Neuse and from near Norfolk, Virginia, six in number, differ from those of the other rivers, in having a deeper body, and generally longer and more prominent mandible. The depth enters the length 2.75 times; in the more western forms always 3.25 times; in the former it is greater than the length of the head, in the latter it is considerably less. Other differences are not discoverable and I regard it as a marked variety only.

POMOXYS, Raf., Agass.

18. POMOXYS HEXACANTHUS, C. V.

Neuse River.

Numerous specimens of this species and the *Pomoxys storerius* from Leavenworth, on the Missouri River, from Saml. H. Edge.

CENTRARCHUS, C. V.

19. CENTRARCHUS IRIDEUS, Cuv., Val.

Vol. III., p. 89, Holbrook Ichth. S. Ca., 18, Tab. III., fig. 1.

From the Neuse River. A specimen presenting an additional dorsal and anal ray, as compared with the description of Cuvier and Valenciennes; but Holbrook adds one to the anal spines, thus agreeing with anal formula D. xii., 14, A. viii., 15. Of a brilliant pea green in life, without ocellus on second dorsal, as described by the above authors. Soft dorsal and anal, with narrow, blackish bars. Not probably specifically distinct from specimens in Mus. A. N. Sci., from South Carolina.

AMBLOPLITES, Raf., Agass.

20. AMBLOPLITES RUPESTRIS, Raf.

Centrarchus aneus, Cuv. Val.

Abundant in the French Broad and head of Cumberland; none found east of the Alleghenies.

CHÆNOBRYTTUS, Gill.

This genus, for which I have reserved the above name, is equally allied to *Lepomis* and *Ambloplites*. It agrees with the first in its entire and rather produced operculum, and three anal spines, but differs materially in possessing the additional maxillary bone of the latter, *Centrarchus*, *Pomoxys*, etc. Gill defined it in consequence of its palatine and lingual dentition, characters which exhibit various grades of imperfection to entire extinction in the typical Lepomes. Hence, in my view of fresh water fishes from the Allegheny region of southwest Virginia, I united *Lepomis*, *Bryttus*, and *Chænobryttus*. I now discover the importance of the presence or absence of the additional maxillary bone, which, with the

emargination of the operculum previously pointed out, enables me to define the genera more satisfactorily than my predecessors. Thus they may be arranged in four groups.

I. Operculum emarginate ; a supernumerary maxillary bone :—Micropoterus, Ambloplites, Pomoxys, Centrarchus, Acantharchus, Emeacanthus (?) Hemioplites.

II. Operculum emarginated ; no supernumerary maxillary :—Meso-gonistius.

III. Operculum entire, produced ; an additional bone attached to the maxillary :—Chænobryttus.

IV. Operculum as last ; no supernumerary maxillary :—Lepomis, Pomotis.

21. CHÆNOBRYTTUS GILLII, Cope.

Lepomis gillii, Cope. Jour. Acad. Nat. Sci., 1868, 225.

This species is exceedingly common in all the streams of North Carolina east of the Allegheny Mountains. It does not occur in the French Broad. All the specimens have clouded markings on the sides, which in the young, are broad, distinct olive-brown cross-bands, which embrace pale spots, giving a chain-like pattern. Fins blackish, cross-barred ; four brown bands radiating backwards from orbit. Iris bright red. The species is rarely seen more than five inches long, and prefers rather still waters. It bites the hook very readily, and is called the red-eyed bream on the Catawba.

The *C. mineopas*, Cope, possesses the additional maxillary, and I have no doubt the *C. melanops* (Gill's type), and the *C. charybdis*, Cope, though I have not been able to verify it on the latter.

ENNEACANTHUS, Gill.

Jour. A. N. Sci. Phil, 1868, 218.

22. ENNEACANTHUS GUTTATUS, Morris.

Proceed. Acad. Nat. Sci., Phila., 1858, p. 3.

Abundant in the Neuse River in still water, as in Virginia and New Jersey.

LEPOMIS, Raf.

23. LEPOMIS RUBRICAUDA, Holbr.

This marked species, the southern representative of the *L. appendix* is very common in the hydrographic basins of the Catawba, Yadkin and Neuse. In life the second dorsal and caudal fins are red, and there is a bay spot at the base of each scale forming interrupted stripes. Flap of operculum black, the continuation of a dark shade from the preoperculum, which is bordered above and below by a blueband ; two blue lines on operculum below the latter.

24. LEPOMIS MEGALOTIS, Raf.

L. incisor Cuv. Val.

From the upper waters of the French broad.

There are several species allied to the present, which may be distinguished, as follows :

Scales 4—35—11.

Dorsal spines short, longest equal muzzle and orbit to pupil ; mucous cavities small ; eye four times in head with long flap, which is black, red bordered below and behind ; anal spine reaching base last anal ray.

L. PELTASTES.

Scales 5—7—36—47—2—14.

Spines of dorsal shorter, equalling muzzle and half orbit ; third spine of anal not reaching base of last anal ray ; ear flap long, blue edged below ; pectoral scales large ; a spot on second dorsal.

L. MEGALOTIS.

Spines etc., as above ; pectoral scales small, no spot on second dorsal.

L. c. 41—4.

L. NITIDUS.

Spines longer than the above, dorsal equal muzzle and orbit .5 or head ; anal reaching base last ray ; opercular flap very small not lighter margined ; spot on second dorsal.

L. c. 36—9.

L. NOTATUS.

Spines longest, more than muzzle and orbit ; anal extending beyond last anal ray ; ear flap very short, not light margined ; spot on second dorsal.

L. SPECIOSUS*

Eye .33 of head ; scales 7—47 ; spines long, equal muzzle and orbit ; anal ray extending beyond base last anal ; opercular flap very small ; spot on second dorsal.

L. PURPURESCENS.

Lepomis nitidus, Kirtland.

L. megalotis, var. B. Cope Journ. A. N. Sci., Phila., 1865, p. 220.

Common in Coal Creek a tributary of the Clinch River ; not seen in North Carolina.

25. LEPOMIS NOTATUS, Agass.

Amer. Journ. Sci. Arts, XVII, 302.

This species is allied to the *L. ardesiacus*, Cope (l. c., p. 222), but its scales are larger, there being but 36—9 on the lateral line, and 13 below it, while there are 45, with 17 below, in the latter. The eye is also larger, entering the head only three times, while it is measured four times by the same in on *L. ardesiacus* of the same size.

The general form is elongate oval, the front of dorsal region steep, the muzzle conic and not obtuse. Eye large and round, its diameter measuring muzzle and half itself, and .2 more than interorbital width : R. D. X. 11, A. III. 10, Depth 2.33 times in length to end of lateral line. Four rows scales on cheek ; no palatine teeth. Scales above lateral line, five large series and one small one. Length 3.5 inches. Color uniform greenish brown, below yellowish ; no band. No red on the very small opercular spot. Fins not cross-barred.

Very abundant in the upper French Broad River, North Carolina, and the tributaries of the Clinch, East Tennessee.

*LEPOMIS SPECIOSUS, Girard. *L. heros* Girard. *L. longispini*, Cope, Journ. A. N. Sci., 1868, 220 : from Texas.

This is probably Agassiz species as above, but the orange on the opercular flap scarcely extends posterior to the black spot, and is easily lost sight of in spirits.

26. *LEPOMIS PURPURESCENS*, Cope.

Species nova.

This is an elevated compressed fish, with very small or rudimental opercular flap, like the *L. notatus*, *L. ardesiacus* and *L. nephelus*. It is similar to the first, and different from the *L. ardesiacus* in its large eye, which enters the head scarcely three times, and the interorbital width .75 times, but agrees with the latter in its small numerous scales. Thus there are six rows of equal scales above the lateral line, and one small one, and 47 on the lateral line and 13 below it; (in the *L. ardesiacus* there are 17 below it.) Depth 2.25 to 2.33 in length (exclus. caudal fin.) The spinous rays of this fish are nearly as long as in the *L. speciosus*. The caudal fin is longer than usual, equalling at least, the head. Length of latter, three times in length of body + head. Six rows scales on the cheek. Length three inches. Mucous cavities small.

Color in life a pale silvery lilac, darkest in four or five vertical shades across the sides, which disappear in alcohol. Fins unicolor except dark shades on middle of anal, and second dorsal and edge of caudal, with a black spot at lower posterior portion of second dorsal.

Abundant in a tributary of the Yadkin River in Roane County, North Carolina.

Lepomis peltastes, Cope.

A deep stout species of small size, distinguished for its large scales, short spines and bright color; mucous caverns small. Eye large, equal muzzle, four times in length of head with long opercular flap, just equal interorbital width. Head with flap 2.5 times in length; depth 2.1 times in same. Caudal fin and peduncle considerably more than one-third the length. Longest dorsal spine equal from end muzzle to middle of pupil; longest anal reaching base last anal ray.

Five rows scales on cheek, three large and two small rows above lateral line; those of middle of sides larger than those on lower part. The profile is regularly descending to end of muzzle; front but little concave. Radii D. X. 11. A. III. 10. Length three inches.

Color above golden brown, sides and belly golden, top of head blackish. Large black opercular spot, red margined below and behind. I dorsal fin blackish, II D. blackish at base orange above, anal similar, caudal blackish, ventrals more or less black. The pectoral fins do not quite reach the base of the anal fin.

This species is from the Huron River, Michigan, whence it was procured through the kindness of my friend Prof. Alexander Winchell, Ann Arbor, Michigan. Its relationships are to the *L. oculatus*, Cope, but in that species the eye is smaller, and the tail and peduncle are .33 of the length. In *L. anagallinus* the mucous caverns are much larger.

POMOTIS, Cuvier.

27. POMOTIS MACULATUS, Mitchill.

Morone Mitchill, *P. vulgaris*, Holbr.

From all the rivers of North Carolina east of the Allegheny Range. Identical with specimens from Pennsylvania and Michigan.

URANIDEA, Dekay.

28. URANIDEA CAROLINÆ, Gill.

Proc. Bost. Soc. Nat. His., 1861. 41.

Abundant in the French Broad River in Madison County, North Carolina.

APHREDODIRUS, Lesueur.

29. APHREDODIRUS SAYANUS, Gilliam.

Journ. A. N. Sci., Phila., IV, 81, pl. III; Dekay, N. Y. Fauna, Fishes p. 35, pl. xxi., fig. 62.

Abundant in sluggish waters tributary to the Neuse River in Wake County, North Carolina.

LABIDESTHES, Cope.

Fam. *Atherinide*. Premaxillary bones prolonged anteriorly into a roof-shaped beak of elongate form, moderately projectile; reaching posteriorly to the line of the orbit: its teeth in several series. Mandible as long as the muzzle. No palatine teeth.

This genus differs from *Chirostoma* (*Atherinopsis*, Blkr.) in the duck-like muzzle, which is almost exactly like that of the *Belonesox belizanus*, though shorter. Like it, the premaxillaries are not coössified, and are separated on the superior surface by a groove between the median portions. The general characters remind one so of *Belonesox*, as to strengthen the belief in the close relationship existing between *Atherinide* and *Cyprinodontide*, though the form is *Acanthopterygian*, and the latter *Malacopterygian*.

Labidesthes sicculus, Cope.

Chirostoma sicculum, Cope. Proc. Acad. Nat. Sci., Phila., 1865, p. 81.

Form slender, the depth contained in the length (without caudal fin)

Fig. 1.



seven times; the length of the head 4.33 times in the same. The eye is large and round, contained 3.6 times in the head, 1.5 times in the length of the muzzle and once in the inter-orbital space. The top of the head and muzzle are plane, the latter convex transversely, and not exceeded by the extremity of the mandible. Front with

a median ridge. A distinct ? mucous pore above each orbit. The teeth

are elongate, slender and simple. The premaxillaries are a little projectile; extremity of maxillary acuminate. The first dorsal commences at a point mid-way between the basis of the tail and the anterior margin of the orbit, or opposite the 3-4th anal radii. The second dorsal commences above a point a little in front of the middle of the anal. Radii D. IV. 10; A. I. 22-3; V. I. 5; P. 12. The scales are small, in 14 longitudinal, and 75 transverse series.

In life this fish is translucent, with a silver band on each side, which covers one scale and two halves, and is lead-edged above. The dorsal region and top of head are dusted minutely with black. Operculum and cheek silvery.

	M.
Length,.....	0.074
Of head,.....	0.015
Of pectoral fin,.....	0.011
Base of anal,.....	0.018
Width head behind,.....	0.006

This little fish I took in great abundance in Coal Creek, a tributary of the Clinch, in East Tennessee. It was very abundant, and easily caught in rather sluggish water. The stream named passing through a limestone region, is liable to partial desiccation in the Autumn, and in several pools, thus formed, I obtained this species.

In the original description I gave D. V., which should probably be as here stated, D. IV.

MALACOPTERYGII.

FUNDULUS, Lac.

30. FUNDULUS CATENATUS, Storer.

Cope, Journ. A. N. Sci., Phil., 1868, Tab. xxiv., fig. 2.

Clinch River, abundant.

HAPLOCHILUS, McClelland.

I refer the following species to this genus, without going into its synonymy, following the arrangement given by Günther in the Catalogue of the British Museum. In consideration of the peculiar views of this author respecting specific and generic characters, I consider this a temporary arrangement, to be rectified by a more thorough analysis of the subject at some future time.*

**Fundulus nisorius*, Cope, Sp. nov.

Stout; head four times in length to basis caudal; orbit four times in length of head, and twice in inter-orbital width. Depth 3.75 times in length. Anal fin commencing about opposite the middle of the dorsal. Cheek scaly, operculum smooth. Scales of body in. 36 transverse, and 12 longitudinal series. Radii D. 12, A. 10 or 11, extending more than half way from basis of first ray to basis caudal. Length of female, four inches. Color uniform light brown, yellowish below.

Most of the specimens of this species (seven) are females, and in them the oviducts are prolonged in a tube to near the extremity of the first ray of the anal fin. Several have many well developed eggs in the former. Small, faintly cross-banded specimens, perhaps males, do not pre-

31. HAPLOCHILUS MELANOPS, Cope.

Sp. nov.

First dorsal ray opposite middle of anal. Scales in. 31 transverse, and 9 longitudinal series. Radii D. 1.6, A. 1.8, V. 6. Head 3.66 times in length, exclusive of caudal fin; eye 3 times in head, 1.6 times in inter-orbital width. Dorsal and anal fins each short, each measuring less than half the distance from their first ray to the basis of the caudal fin. Caudal narrowed, rounded.

Above, yellowish brown, scales darker edged, a few longitudinal lines on some dorsals; in some specimens, a median brown dorsal line. Dorsal and caudal fins each with a row of black dots across the middle, and one near the margin. Belly golden. Length 1.5 inches, the largest size. Δ blue-black spot below the eye in most specimens.

Very abundant in still waters of the Neuse basin, Wake Co., N. Ca.

ESOX, Linn.

32. ESOX AFFINIS, Holbrook.

Ichth. S. Carolina, 198, Pl. xxviii., fig. 1.

This species is near to but distinct from the *E. reticulatus* of the North. In life it is of a bright light emerald green, with dark reticulations. Common in the Neuse River.

33. ESOX RAVENELII, Holbrook.

Ichthyology South Carolina, p. 201, Pl. xxvii., fig. 2.

Length from muzzle to pectoral equalling length from pectoral to ventral fin; latter space embracing 37 transverse series of scales. From end muzzle to orbit less than from orbit to opercular border. Br. XIII. D II. 12. Brown above with brown cross-bars; edge of dorsal and caudal fins red.

This species is near *E. americanus*, but has a relatively longer head. Size and color similar. From the Catawba River, N. Ca.

SEMOTILUS, Rafinesque.

Putnam, Cope.

34. SEMOTILUS CORPORALIS, Mitchill.

From the French Broad, Catawba, Yadkin, Deep, and Neuse Rivers.

CERATICHTHYS, Baird.

Four species of this genus were observed, of which two are new to Zoology. They both belong to

Sect. II., mouth more or less inferior, small; teeth 4-4 or 4. 1.—1. 4; size small.

Depth less than length head; last dorsal ray more than half first; muzzle narrow, beards long; small;

C. LABROSUS.

sent this character. There are no pseudo-branchiae. From Gaboon, W. Africa. P. B. DuChaillu.

It may be stated in this connection that the genus called *Lycocyprinus* by Peters, for Haplochioid fishes with pseudobranchiae, was previously named *Epiplatys* by Gill. The type of the latter (*E. sexfasciatus*, (1862) from Gaboon, is different from the *E. (L.) sexfasciatus* (1864), the type of Peters. The latter may, therefore, take the name of *E. infra fasciatus* (1865), which Günther gave the same species, subsequent to Peters.

Depth equal length head; last dorsal ray less than half first; muzzle broad, beards small; C. HYPsinOTUS.

35. CERATICHTHYS LABROSUS, Cope.

Spec. nov.

This is a peculiar species of slender proportions. The top of the head is gently decurved to a muzzle which scarcely overhangs the thick, projectile upper maxillary arch. The mouth is entirely horizontal, and the extremity of the maxillary bone attains the line of the orbit. The latter enters the length of the head 3.75 times, and is just exceeded by the inter-orbital width. The head enters length to origin caudal from 4 to 4.5 times. Front arched in transverse section. Depth 5.5 times in length. The dorsal line is nearly plane, and the elevation of the first dorsal rays is contained twice in the length from its base to the anterior rim of the pupil: it stands over origin of ventral. Scales large 6—34—5—4. Radii D. 8; A. 8.

	Lines.
Total length.....	29.5
Of caudal fin.....	5.1
Of head.....	5.8

Teeth 4. 1—1. 4.

This fish is silvery from the middle of the sides downwards. In some specimens there are numerous blackish scales above the lateral line, which are arranged so as to form indistinct cross-bars in life; in other specimens the color is quite transparent, indicating two varieties. The latter are frequently a little more slender than the former.

The beards of this species are relatively longer than in any other species of the genus. The prominent lips remind one of *Phenacobius*. The species is not uncommon on the bottom in clear and rapid creeks which flow into the upper waters of the Catawba River, in Macdowell and Burke Counties, N. Ca.

36. CERATICHTHYS HYPsinOTUS, Cope.

Spec. nov.

This little species has a stout robust form. The head and muzzle are broad and flat; the muzzle is not prominent; the mouth is inferior and horizontal; the maxillary just reaches the line of the orbit. The form is characterized in the genus by the gradual elevation of the dorsal line to the base of the first ray of the dorsal fin, and its rather abrupt descent from that point. The base of this fin is thus oblique and the distal outline is vertical; the posterior ray being less than half as long as the anterior. This produces a characteristic appearance. The head is short and enters the length 3.75 times, equalling the depth. Body compressed. Orbit 3.5 times in length head, and once in inter-orbital space. Lips, especially inferior, thin; beards small. Scales, 4—5—38—41—3. Teeth 4. 1—1. 4. Dorsal fin originating a little in advance of above ventrals; 8. A. smaller than dorsal, 8.

	Lines.
Length.....	33.6
Caudal fin.....	6.5
Depth.....	7
Width head behind orbits.....	3.5

Color in life silvery, with a double series of black specks along the lateral line, and a lateral band of dusted blackish; a dark line round muzzle between orbits. Membrane of dorsal fin often shaded with blackish.

Common in creeks heading the Catawba R., in Macdowell Co., N. Ca., or tributary to the Yadkin River in Roane Co., in the same State.

37. CERATICHTYHS HYALINUS, Cope.

Jour. Acad. Nat. Sci., Phil., 1868, 226.

From the French Broad and Clinch Rivers in North Carolina and Tennessee; not found east of the Alleghenies.

38. CERATICHTHYS BIGUTTATUS, Kirtl.

Trans. Amer. Philos. Soc., 1866, 366.

Found in the rivers of East Tennessee and North Carolina, from the heads of the Cumberland, to, and including, the Neuse.

ARGYREUS, Heckel.

39. ARGYREUS LUNATUS, Cope.

Proc. Acad. Nat. Sci., 1864, 278. Jour. Acad. Nat. Sci., 1868, 228, Tab. 23, fig. 3.

Common in the tributaries of the French Broad and Holston Rivers, in North Carolina and Tennessee. The absence of any species of this genus in the rivers of North Carolina east of the Alleghenies is a peculiar feature. They no doubt occur in the Roanoke, as I have taken *A. atronasus* from that river in Virginia.

HYPHILEPIS, Baird.

40. HYPHILEPIS COCCOGENIS, Cope.

Proceed. Acad. Nat. Sci., 1867, 160.

Common in the French Broad and Clinch Rivers. Not found in the Beech Fork of the head of the Cumberland.

41. HYPHILEPIS CORNUTUS, Mitch.

Var. *frontalis*, Agass., Cope, l. c., 158.

Abundant in Coal Creek, a tributary of the Clinch River in Tennessee:

Var. *cornutus*, Cope, l. c. From the Neuse River.

42. HYPHILEPIS ANALOSTANUS, Girard.

Cope, l. c., p. 161.

Found in abundance in the Catawba River, but nowhere in the tributaries of the Tennessee or Cumberland. Found in the Neuse River.

43. HYPHILEPIS GALACTURUS, Cope.

Loc. cit., 160.

Most common in all the tributaries of the French Broad, Clinch and Cumberland. It does not occur east of the Alleghenies.

Hypsilepis ardens, Cope.

Loc. cit., p. 163.

Abundant in the headwaters of the south fork of the Cumberland River in Tennessee. In my examination of the Virginia streams, I did not find it in any western water, but only in the Roanoke and James Rivers.

HYBOPSIS, Agass.

Cope. Transac. Amer. Philos. Soc., 1866, 379.

GROUP A.

44. HYBOPSIS AMARUS, Girard.

Proceed Acad. Nat. Sci., Phila., 1856, 210. *Hybopsis phaëna*, Cope, l. c. 1864, 279.

Specimens from the Catawba River all have a relatively longer head than typical examples from the Potomac; former 4 times in length to basis caudal fin; latter 4.5 times. They have also teeth 4.1—1.4, in place of 4.2—2.4; the three inferior of the outer row obtuse, without hook, the superior one only with masticatory face. Both varieties may really belong to the *H. hudsonius*, as indicated in Monograph Cyprinidæ Pennsylvania.

GROUP B.

Hybopsis longiceps, Cope.

Journal Acad. Nat. Sci., Phila., 1868, 231.

Abundant in the head waters of the Cumberland River, and Coal Creek, a branch of the Clinch River, Tennessee. Originally found in the Roanoke and James Rivers, Virginia.

45. HYBOPSIS SPECTRUNCULUS, Cope.

Loc. Cit. 231.

From the tributaries of the French Broad in the high valley of Henderson County, North Carolina.

GROUP BB.

Teeth + 4. 4 +; mouth horizontal, lower jaw received beneath upper.

46. HYBOBSIS NIVEUS, Cope.

Spec. nov.

Char. Head 4.5 in length; depth 5 times in the same; eye 3. 3 in head, equal muzzle. Scales $\frac{38-46}{3}$; anal 1. 8. White, a black spot on dorsal fin behind.

Description. This is a regularly fusiform fish, the dorsal region more arched than the ventral. Head conic, muzzle obtuse, not projecting, mouth nearly terminal; preorbital large, longer than deep. Occipital region arched, its breadth at superior extremity of operculum equal from end muzzle to middle pupil. Muzzle about equal orbit, preorbital bone elongate; end of maxillary extending to opposite anterior rim of orbit.

Mouth slightly oblique downward, mandible included; isthmus medium. Fins D. I. 8, A. I. 8; the osseous dorsal ray separated from the first cartilaginous by a narrow membrane, and originating above the ventrals. Posterior ray 3-5 length of the anterior.

Length 31.3 lines; of caudal 5.8 lines; to basis dorsal 12.9 lines. From basis to apex pectorals 4.1 lines; same to basis ventrals 13 l.

Color in life very pale, sides and below silvery; a blackish spot at basis caudal, and a large dark spot at upper posterior part of dorsal fin.

Common in the upper waters of the Catawba River, North Carolina.

GROUP D.

Teeth 4.1—1.4; lateral line little decurved; scales $\frac{(5)-6}{39}$; muzzle short obtuse; interorbital region wider; depth 5; head 4 times in length. A. I. 8.

H. CHLOROCEPHALUS.

Teeth 4.2—2.4; lateral line much decurved; scales $\frac{7}{31-7}$; muzzle acuminate, interorbital space narrower; depth 5.5, head 4 times in length. A. I. 8.

H. CHLITICUS.

47. HYBOPSIS CHLOROCEPHALUS, Cope.

Spec. nov.

This small species is rather stont and has a deep caudal peduncle. The head is broad with large orbit, descending muzzle, and descending mouth, orbit in head three times, diameter exceeding length of muzzle. End of maxillary extending beyond line of orbit; premaxillary margin barely reaching plane of lower margin of pupil. Interorbital width much more than length of muzzle. Lateral line moderately decurved. Dorsal fin above ventrals, elevated: R. I. 8, A. I. 8.

Length (total) 27 lines; to origin dorsal 11.9 lines; to basis caudal 21.6 lines. Everywhere, except on belly and below orbits, thickly dusted with blackish, especially gathered into a lateral band which terminates in a basal caudal spot. Fins unspotted, in life a metallic green line on the vertebral line, and one from the upper angle of each operculum to caudal, visible in several lights; below the latter, dark crimson; dorsal and caudal fins, operculum and cheek with end of nose, all crimson. Part of operculum, preoperculum, postfrontal region and top of head metallic green.

This surpassingly beautiful fish is abundant in the clear waters which it inhabits, viz: the tributaries of the Catawba River.

This species may be compared with *H. rubriroceus* and *H. plumbeolus* as its nearest allies. The former has a relatively larger head, and more slender caudal peduncle, A. I. 9. The latter is much shorter and deeper fish; its depth enters the length 4.6 times; the eyes the head only 2.75 times.

48. HYBOBSIS CHILITICUS, Cope.

Spec. nov.

This species is an ally of the last ; it has a more clupeoid aspect, seen in strongly decurved lateral line and more acuminate muzzle. Head broad behind occiput, convex, interorbital width less than length of muzzle, orbit 3 times in head, exceeding length of muzzle; maxillary extending beyond its anterior rim. Teeth 4.2—2.4. Dorsal small, originating above ventrals, R. 1. 8, A. 1. 8. Line of premaxillary margin opposite middle of pupil.

Length 24.4 lines ; to basis dorsal 12.4 l. to basis caudal 24.4 l. Length pectoral from base 5 ; from same base to do. ventrals 5.7 lines.

In life pure silver white to the dorsal line ; the dorsal scales brown edged ; a vermilion band through anal fin and one through dorsal ; the lips vermilion all round the mouth.

This species is as beautiful as the *H. chlorocephalus* ; if not as rich, its tints are much more transparent. Common in the tributaries of the Yadkin River, in Roane County, North Carolina.

HEMITREMIA, Cope.

Genus novum.

Char. Dentition 5—4, with marked masticatory surface. Alimentary canal short, with the usual two flexures. The lateral line one-half wanting, and generally imperfect. First (osseous) dorsal ray adherent. Pre-maxillary projectile.

This genus is *Hybopsis* with teeth 5—4, and undeveloped lateral line. perhaps it will be necessary in future to refer *H. heterodon* and *H. bifrenatus* to it.

Hemitremia vittata, Cope.

This is a stout species with very short head and obtuse muzzle. The latter is rounded horizontally from the orbits. The mouth is short and oblique ; the end of the maxillary does not reach the orbit. Diameter of orbit equal muzzle, 3.5 in head ; 1.33 times in interorbital width. Length head 4.2 times to base caudal ; depth 4.5 in same isthmus rather wider. The first dorsal ray originates a little behind above the ventrals ; scales

$\frac{6}{38}$ Radii D. 1. 8 ; A. E. 7. Length to basis caudal 24.4 lines. Do to basis dorsal 13.2 lines ; length pectoral 4.2.

The specimen is alcoholic, and I do not know the colors in life. There is a conspicuous dark shade along the median lateral line, and a pale band above it ; above this the whole dorsal region is of a dark color.

This species is from the tributaries of the Holston River, near Knoxville, Tennessee, and was procured by my friend, Prof. Harrison Allen, who submitted the specimen to me for examination.

PHOTOGENIS, Cope.

Proceed. Acad. Nat. Sci., 1867, 163.

49. PHOTOGENIS LEUCOPS, Cope.

Var. *aaaa*. Depth into length to basis caudal fin 6.5 to 7 times; head in same 4.5 times; scales $\frac{6-7}{2}$ abundant in the French Broad River.

Var. *aaaaa**. Depth into length 5 times; length head into same 4 times; scales $\frac{5-6}{3}$; color silvery, a double row of black specks on lateral line. Very abundant in the head waters of the Catawba River. This fish, when taken from the water, always sustains a rupture of some of the branches of the ophthalmic artery by which blood is suffused beneath the cornea. The altered condition of pressure on transfer to a rare medium, is no doubt the cause.

Also from the Neuse River, near Raleigh.

50. PHOTOGENIS TELESCOPUS, Cope.

Loc. Cit. 165.

Very abundant in the French Broad River; a variety with large eye in a tributary of the Clinch.

51. PHOTOGENIS LEUCIODUS, Cope.

Loc. Cit. 165.

Abundant in the waters of the tributaries of the French Broad River.

52. PHOTOGENIS PYRRHOMELAS, Cope.

Spec. nova.

This species is in most characters related to the *Hypsilepides*, and it combines remarkably the characters of the *H. cornutus*, *H. analostanus*, and *H. diplœmia*. Thus it has the head of the first, the form, with milky paired, and black spotted dorsal of the second, and the long anal of the third. As the teeth are without masticatory surface, I refer it for the present to this genus.

The extremity of the muzzle descends obliquely to the mouth, which is itself oblique, the end of the maxillary descending to a line from the anterior margin of the orbit. The mandibular and premaxillary margins are in the same vertical line when the mouth is closed. The diameter of the eye ball enters the length of the head 3.6 times, and 1.25 times in interorbital width. Length of head four times in length, depth about the same. The body is therefore rather deep and compressed. Teeth sharp, hooked, 4.1—1.4. Radii D. I. 8, A. I. 10. V. 8. The extremities of the pectorals barely reach the ventrals, and the ventrals attain the anal.

Scales $\frac{6}{3}$; most of them with narrow exposed surfaces, as in typical *Hypsilepis*. Total length 40 l.; to orbit, 2.8 l.; to origin dorsal fin 16.5 l.; to origin caudal 32.7 l.

In coloration this is again one of the finest of our *Cyprinidæ*. Specimens taken in autumn were steel blue above, the scales darker edged; the belly silver. The muzzle and upper lip to the end of the maxillary, are vermil-

lion; also, the iris above and below the orbit. The dorsal fin has a large black spot on the posterior half; the fin is anteriorly vermillion. The tail has a rather broad black posterior margin, and a wide vermillion crescent following it into the points of the fin; base of the fin pale. Anal and ventral fins with milky pigment.

Small horny tubercles appear on the upper surface of the head in spring, as in the species of *Hypsilepis*.

In this case I have assigned this species to its genus in accordance with its technical characters, but it is probable that it will be necessary to change the arrangement at some future time,—when the structure of these fishes is better known.

The *P. pyrrhomelas* is the most abundant fish in the tributaries of the upper Catawba River, North Carolina.

ALBURNELLUS, Girard.

Several species of this genus were obtained, and may be compared with others already known, as follows:

I. Ventral fins extending beyond dorsal, reaching anal.

Scales 5—36—2; dorsal much elevated. A. 8. A. ALTIPINNIS.

II. Ventrals extending to opposite last dorsal ray; not to anal.

a. Scales above lateral line 5—6.

β . Scales large, lateral line 33.

Orbit large.

A. MEGALOPS.

$\beta\beta$. Scales smaller, l. l. 38—40.

Scales $\frac{5}{3}$; head smaller, body stouter. A. 8, eye smaller. A. AMABILIS.

Scales $\frac{5}{2}$; head larger, body slender. A. 10, eye larger.

A. JACULUS.

Scales, etc., as last; eye much larger.

A. ARGE.

aa. Scales above l. l. 7.

Scales $\frac{7}{3}$; slender. A. 11.

A. MATUTINUS.

aaa. Scales above l. l. 9.

Rather stout.

A. UMBRATILIS.

III. Ventrals only extending to line of middle of dorsal.

Head 4.5 in length; scales $\frac{39}{3}$.

A. MICROPTERYX.

53. ALBURNELLUS ALTIPINNIS, Cope.

Spec. nov.

This species is much less elongate than such typical forms of the genus as *A. jaculus*, etc. The head is short, but not wide. Orbit very large, diameter exceeding muzzle, entering length of head 2.75 times, one-third greater than the interorbital width. Head 4.33 times in length to basis of caudal, depth five times in same. Anterior dorsal radii unusually prolonged for the genus, equal just half distance from the base to end of muzzle. D. I. 8. A. I. 9. The pectorals do not quite reach the base of the

ventrals. Total length 26 lines; to basis of dorsal 11 lines; to basis caudal 21 lines.

Color white, a broad lateral silver band punctulated with strong black dots. A black band across operculum to orbit, and black spot on pre-orbital bone. Top of head to origin premaxillaries black shaded.

Two marked bony ridges connected with the system of mucons tubes, diverge from the apices of the premaxillary bones to the epiotic region on each side enclosing an urceolate interspace.

From the Yadkin River, Roane County, North Carolina.

54. ALBURNELLUS MATUTINUS, Cope.

A compact slender species with small scales. Orbit large, contained 3.5 times in length of head, and scarcely larger than length of muzzle, equal also interorbital width. Length of head contained 4.25 times in total less caudal fin, depth six times in same. Length of first dorsal ray just .33 distance from its base to end of muzzle. Pectorals considerably short of ventrals, ventrals short of anal. R. A. I. 11. Twenty-five rows of scales across dorsal line in front of dorsal fin.

Length 32 lines; to basis dorsal 14.4 lines; to basis caudal 26 lines.

Above olivaceous, edges of scales brown shaded; lateral band plumbeous; sides and below silvery, a dark spot at base of caudal fin. End of muzzle and chin bright rufous.

From the Neuse River, in Wake County, North Carolina. The first species of the genus found in Atlantic waters.

55. ALBURNELLUS MICROPTERYX, Cope.

Journal Ac. Nat. Sci., Phila., 1868, 233.

Several specimens of this species were taken in Coal Creek, a tributary of the Clinch River, Tennessee, and preserve exactly the characters by which this species was originally distinguished from *A. jaculus* m.

CLINOSTOMUS, Girard.

56. CLINOSTOMUS AFFINIS, Girard.

Jour. A. Nat. Sci., Phila., 1868, 228.

Very abundant in the waters of the Catawba and Yadkin.

STILBE, Dekay.

57. STILBE AMERICANA, Linu.

Common in still and sluggish water of the Catawba, Yadkin and Neuse Basins.

HYBOGNATHUS, Agass.

The species of this genus are few, and have a wide distribution. Those known to the writer are distinguished as follows:

I. Suborbital bones broad, short; speculum on postfrontal region large. Scales $\frac{2}{3}$; eye small, one-sixth of head, twice in muzzle; A. 8.

H. PLACITUS.

Scales 5-39 $\frac{1}{2}$, eye 4.25 to 4.5, less than length muzzle; head wide, entering length 4.66 times; A. 8.

H. NUCHALIS.

II. Suborbital bones long, slender; speculum on postfrontal region little marked.

Scales 6-38-4; head 4.75 times in length, wide; eye large 3 times in head, larger than length muzzle; A. 7.

H. OSMERINUS.*

Scales 5-6-36-3-4; head narrow 4.25 times in length; eye large, diameter exceeding muzzle, 3.3 times in head; A. 8.

H. ARGYRITIS.

58. HYBOGNATHUS ARGYRITIS, Girard.

Proc. Acad. Nat. Sci., Phila., 1856, 182. U. S. Pac. R. R. Surv., vol. X, Tab.

This species was described by Dr. Girard, from specimens obtained by the U. S. Explorations for the Pacific Railroad route, from the Milk and Arkansas Rivers. It appears to be very abundant in the Catawba River, North Carolina. Specimens from it cannot be distinguished from those from the Arkansas in the Museum of the Smithsonian Institution.

CAMPOSTOMA, Agass.

59. CAMPOSTOMA ANOMALUM, Raf.

Rutilus Raf., *Campostoma*, Agass.

From the Cumberland, Clinch and French Broad Rivers, west of the Alleghenies and the Catawba River east of them.

CATOSTOMIDÆ.

Prof. Gill proposed to distinguish this group from the Cyprinidæ as a family (in Proc. Acad. Nat. Sci., Phila., 1861, p. 8), basing the latter on the peculiar characters of the pharyngeal bones and teeth. This course has not been followed by subsequent writers, and the character assigned does not appear to me to warrant the proposed separation. I find, however, that while the premaxillary bone completes the superior arch of the mouth in the Cyprinidæ, in the Catostomidæ, those bones form but a slight portion of the same, the maxillary bones entering into it extensively on each side. This feature is evidently of importance sufficient to define the family, and I therefore adopt it as left by Prof. Gill.

*HYBOGNATHUS OSMERINUS, Cope spec. nov.

The characters of this species are expressed in the above table. It is very near the *H. argyritis* Gir., but has a materially shorter head and smaller anal fin. The head is relatively wider. The preorbital bone is about as long as deep. The mandible very attenuate, and with a slight symphyseal tubercle. End of maxillary not beyond line of posterior nares. Orbit large. D. I. 8, A. 17. (*H. regius* has II-9 A., according to Girard.) Total length 31.2 lines; of head 5 l.; to basis dorsal 12.5 l.; to basis caudal 12.7 l. Pectorals and ventrals very short; first articulated dorsal ray 6 lines long. A broad silver lateral band; bright olive above it, pale below it; no black spot on basis caudal. Speculum on postfrontal region small and little visible.

This species is abundant in the Raritan River, New Jersey, in early spring ascending the river with the smelt (*Osmerus*). Discovered by my friend, Dr. Chas. C. Abbott, of Trenton, who is investigating the ichthyology of New Jersey.

PLACOPHARYNX, Cope.

Genus novum.

Allied to *Ptychostomus*, Ag. The pharyngeal teeth much reduced in number, only seven on the proximal half of the bone, cylindric in form, with a broad truncate triturating surface. These play against a broad crescentic chitin-like shield on the posterior roof of the pharyngeal cavity. Three divisions of the vesica natatoria.

With a great superficial resemblance to *Ptychostomus*, the masticatory apparatus is different from that of any Catostomoid form known to me, and combines peculiarities observed in forms of true Cyprinidæ. The chitin-like shield is found in some of the latter; it is represented in *Catostomus*, *Ptychostomus* and *Carpiodes*, by a narrow and very thin pellicle of the same material, frequently interrupted on the middle line.

I know as yet but one species of the genus.

Placopharynx carinatus, Cope.*Species nova.*

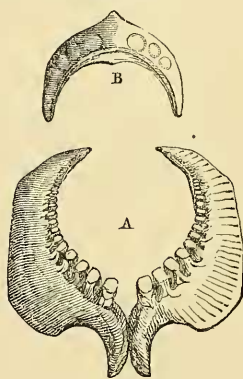
The physignomy and proportions of this sucker are those of the *Pt. erythrurus* or the "red horse" of the Western Rivers.

The lips are large and plicate, the anterior pendent like that of the *P. collapsus*, the posterior full like that of *Pt. cervinus*. Muzzle vertically truncate. Length of head in that of body four times; depth of body in same 3.66 times; scales 6—41—5. Radii D. XIV, V. 9. A. 7. Free margin of dorsal straight, not elevated anteriorly. Occipital region more elevated medially than in *Pt. erythrurus*, superior ridges well marked, with a special addition characteristic of this species, and of none other with which I am acquainted. This is a median longitudinal frontal ridge, extending from the fontanelle to between the nasal ridges. Only the posterior extremity of this ridge appears in some *Ptychostomi*. Orbit longitudinally oval, 4.5 times in length of head, twice in interorbital width. Type, fourteen inches in length.

Color in alcohol like that of other species, uniform straw or whitish silvery.

The pharyngeal bones of this species are much stouter than those of other species of its own and greater size, e.g., *Pt. aureolus* of eighteen inches, where they are comparatively slight. The exteroposterior ala is twice as wide as the body inside the teeth is deep, and but for its short base and narrowed tip would do for that of a *Semotilus*. But while there are seven broad teeth without heel or cusp on the basal half, there are at least forty on the distal half, they becoming more compressed and finally like those of other allied genera. There are fourteen with truncate ex-

Fig. 2.



tremities. The pharyngeal plate has narrow horns directed upwards and forwards, and is thickened medially. It is placed immediately in advance of the opening of the oesophagus. I have but one specimen of this curious species, which I obtained at Lafayette, on the Wabash River, in Indiana.

CATOSTOMUS, Lesueur.

60. CATOSTOMUS TERES, Mitchill.

Cyprinus teres, Mitch. *Catostomus teres*, *C. communis* and *C. bostoniensis*, Les.

Common in all the rivers of the State and on both sides of the Allegheny water-shed.

61. CATOSTOMUS NIGRICANS, Les.

C. planiceps, Cuv. Val.

Common in the Clinch, Cumberland and French Broad Rivers.

An especially western species, and abundant, where it occurs.

62. MOXOSTOMA, Rafinesque.

MOXOSTOMA OBLONGUM, Mitch.

Catostomus tuberculatus and *vittatus*, Lesueur. *Labeo oblongus*, DeKay.

In North Carolina, as in Pennsylvania, this species is confined to the sea-board streams. I only found it in the Neuse.

PTYCHOSTOMUS, Agass.

Amer. Journ. Sci., Arts XIX. 88. *Teretulus*, Raf. Cope emend. Journ. Acad. Nat. Sci., Phila., 1863, 235.

The species of this genus are found in the United States, South of New York and East of the Rocky Mountains, including the waters of the great lakes. They are especially numerous in the rivers of North Carolina, which flow into the Atlantic, and constitute one of the peculiarities of that shed of the Allegheny range, as distinguished from the streams of the western slope in Tennessee, where a smaller number of species is found. Wherever Ptychostomi occur they are abundant in individuals.

The development of the lips furnishes important diagnostic indications in this genus. In those most nearly allied to Moxostoma, the inferior lip resembles that of that genus, in being narrower, and deeply incised, emarginate posteriorly forming a figure V with the apex forwards; at the same time the superior lip is very thin, and often narrow. Such species are shorter, and tend to a large development of dorsal fin. Others of this type are more elongate. The more typical forms have a large inferior lip, which is generally produced posteriorly to a square transverse margin. Most of these are more elongate species than the last group. Some species of both are distinguished by their very prominent conic muzzle, and minute inferior mouth, reminding one of the Carpiodes. In one species the surface of the lips is papillose instead of plicate. In some species the mouth is very projectile, in others scarcely so at all.

Rafinesque proposed a genus *Teretulus* on the characteristic peculiarity of nine ventral radii, belonging to most of the species of this genus. He, however, included species of two other genera. On this account Agassiz, in rearranging the suckers, imposed on it the name standing at the head of this article, regarding the plicate lips as a primary character. I think Rafinesque's name is to be rejected, owing to its ill application; the more as I find two species in which there are ten ventral radii. I adopt that of Agassiz, though I showed, when describing the *Pt. cervinus*, that the tricellular natatory bladder is a more distinctive feature. This becomes the more obvious now that I have found a species where the lips are tubercular instead of plicate.

The following scheme will render the identification of the species more simple.

- A.* Lips pappillose, inferior Λ shaped.
 - Head elongate, muzzle truncate. P. PAPPILLOSUS.
 - AA.* Lips plicate.
 - a.* Inferior lips infolded, Λ shaped.
 - β . Oblong species; head one-fourth the length.
 - Eye large; D. XVI; form compressed. P. VELATUS.
 - Eye smaller; D. XV; compressed. P. COLLAPSUS.
 - Eye smaller; D. XII; subcylindric. P. PIDIENSIS.
 - $\beta\beta$. Fusiform species; head one-fifth the length.
 - Muzzle conic; mouth minute inferior. P. COREGONUS.
 - aa.* Inferior lips narrow, crescentic.
 - Head one-fifth length, muzzle sub-conic. P. ALBUS.
 - Head long, truncate, $\frac{1}{4}$; fins white. P. THALASSINUS.
 - aaa.* Inferior lips well developed, truncate posteriorly.
 - β . Compressed species.
 - γ . Head $4\frac{1}{2}$ in length.
 - δ . Dorsal radii XII.
 - Stout, elevated; muzzle short, fins crimson. P. ROBUSTUS.
 - $\delta\delta$. Dorsal radii XIII.
 - ϵ . Ventral radii IX.
 - Head longer, occipital region flat, muzzle truncate, eye smaller 4.5; scales 5—42—4; scales white. P. ERYTHRURUS.
 - Head shorter; occipital region convex; muzzle projecting, mouth inferior, eye larger 3.5 in head; scales black at base. P. MACROLEPIDOTUS.
 - Head elongate, convex with ridges above occiput; eye 4.5 in head; muzzle prominent, mouth inferior; scales white. P. LACHRYMALIS.
 - $\epsilon\epsilon$. Ventral radii X.
 - Head 4 times; muzzle conic. P. DUQUESNEI.
 - $\delta\delta\delta$. Dorsal radii (XVII) XVIII.
 - "Eye small; depth 3.25, head 4.3 times in length." P. CARPIO.

$\gamma\gamma$. Head five times in length ; occipital region strongly convex.

δ . Ventral radii IX.

D. XIII. muzzle little prominent, dorsal truncate.

P. AUREOLUS.

D. XII. Muzzle projecting ; lips large.

P. CRASSILABRIS.

$\delta\delta$. Ventral radii X.

D. XIII. Muzzle projecting, mouth inferior. D. free border deeply incised.

P. BREVICEPS.

$\delta\delta\delta$. Ventral radii unknown.

D. XIV. Muzzle produced convex, mouth very small, back elevated.

P. CONUS.

$\beta\beta$. Cylindric species.

D. XI, XII. Head one-fifth length ; sides lined.

P. CERVINUS.

63. PTYCHOSTOMUS PAPPILLOSUS, Cope.

Species nova.

Body deeper than thick, the dorsal outline not at all elevated. Head elongate not more than one-fourth the length to base of caudal, the orbit small and bordering the frontal plane. Preorbital region most elongate in the genus ; muzzle truncate in profile ; the upper lip hanging free, the lower deeply incised behind so as to be Δ shaped, and with the upper, finely granular, not plicate. The muzzle very projectile, more so than in any species of the genus. The top of the cranium is everywhere plane. Dorsal fin truncate, with XII radii. Scales large, about as in P. COLLAPSUS, Cope, i. e. 6—42—5.

Color everywhere a silvery white, except some blackish shades at the bases of the scales of the dorsal region. The fins, unlike those in most other species, are pure white in life. They obtain one foot in length, and do not exceed one pound in weight.

This species is quite abundant in the Catawba and Yadkin Rivers, in North Carolina, and is highly valued by the inhabitants as an article of food. It is regarded as the best of the Catostomi for this purpose. It is less frequently caught on a hook than some other species, but in the autumn they come on the weirs in considerable numbers ; from these I procured many specimens. The fishermen call it the "Shiner." Its characters are very constant, and not likely to be confounded with those of any of the known Ptychostomi.

Ptychostomus velatus, Cope.

Species nova.

This is a stout species, with a short head, large eye, and more than usually elongate dorsal fin. Scales 5—6—42—5 ; head scarcely 4 times in length ; superior plane nearly flat ; orbit 3.75 times in length of head ; 1.5 times in interorbital width. D. XVI. with straight superior margin ; V. IX. Upper lip pendent. Dorsal outline arched to the first dorsal ray greatest depth 3.2 lines in length (exclus. caudal). Total length 11 inches.

The color of this species I cannot give, as I have not seen it in life ; in spirits it is uniform silvery, the dorsal fin dusky.

I know this fish from two specimens which I caught in the Youghiogheny River, in Western Pennsylvania.

64. *PTYCHOSTOMUS COLLAPSUS*, Cope.

Species nova.

This very abundant fish is in the form of its lips similar to the last. It is stout and short, the head not entering the length (exclus. caudal) quite four times. The dorsal line is somewhat elevated to the first ray of the dorsal fin, the depth entering the length 3.5 times. The eye is smaller than in the *P. velatus*, entering the length of the head 4.75 and 5 times, and the interorbital width 1.75 times. Top of head plane ; muzzle moderately prominent, intermediate between *P. erythrurus* and *Pt. conus* in this respect, being more compressed than in the last. Mouth small, little projectile, superior lip pendent. D 15, V. 9. Thoracic region with small scales.

The specimens of this species from most of the North Carolina Rivers are rosy on the sides, the larger, light golden ; the inferior fins all orange. The specimens from which the above description is taken are small, only a foot long, but I have seen several specimens in the Catawba River, of three and four pounds in weight.

It occurs in the Neuse, Yadkin and Catawba Rivers, in North Carolina, the Clinch River in Tennessee, and I have a specimen from the Wabash River, in Indiana, and three others without locality, but probably from the Western States or Great Lakes. In the Yadkin and Catawba Rivers it is immensely numerous, and is caught on weir traps in the spring and autumn in quantities, and used as food by the inhabitants. It is not as good a fish as the *P. papillosum* and *P. robustus*, but is not at all to be rejected.

There seemed to be a larger number of smaller specimens in the Yadkin than the Catawba Rivers at the time of my visit. The specimens from the Neuse have the muzzle a little more prominent. Some specimens from the Yadkin possess only XIII and XIV D. rays.

65. *PTYCHOSTOMUS PIDIENSIS*, Cope.

Species nova.

A smaller species than either of the preceding, of more cylindric and less compressed form. The dorsal fin is shorter, containing only XII rays. Head elongate, about four and a half times in length exclusive of caudal fin. Muzzle not conic, but truncate. Scales similar to those of the last species. Length about ten inches.

Color light brownish yellow, fins light red.

This fish resembles at first, the *Pt. cervinus*, both in color, form and size. I obtained a few specimens from the traps in the Yadkin River, at the plantation of John Kuntz, and did not see it in any other river.

I took a variety in a tributary stream, characterized by a longitudinal black spot at the base of each scale, giving a handsome longitudinal

striation. (A similar variety of *Hypsilepis analostanus* (q.v.) was taken in the same stream.) Scales 6—44—5. V. IX. A. VII. Head flat above; eye 4 times in head, 1.5 times in interorbital breadth. Dorsal and caudal fins black edged.

66. PTYCHOSTOMUS COREGONUS, Cope.

Species nova.

This fish is very easily distinguished by its very small head, with conic muzzle, and elevated arched back, combined with a small size, and other characters.

The head enters the length not less than five times, and is much arched in transverse section posteriorly above. The diameter of the eye is large, entering the head between three and four times; the muzzle is regularly conic, and projects far beyond the mouth. The latter is remarkable for its small size, and lack of projectility; in ordinary individuals it would about admit a pea. The upper lip is not pendent below the front of the muzzle. The shape is broadly fusiform, the dorsal line rising to the fin. It is, nevertheless, more compressed than the species already described. D. XIV constantly.

The ground color is silvery, the scales shaded with leaden above, and with black pigment at their bases, giving a dusky hue to the whole, as is not seen in the species already described, except the *P. papillosus*. Belly and inferior fins pure white, lacking the red and orange of many others.

This fish never exceeds a foot in length, and is very abundant in the Catawba and Yadkin Rivers. It is caught with the preceding two species and is used for food, but is the least valued of all the species. It is called at Morganton, "blue mullet."

67. PTYCHOSTOMUS ALBUS, Cope.

Spec. nov.

This large species has the small head of the last, without the small mouth and many of its other peculiarities. The head enters the length not less than five times; muzzle is prominent, but the mouth is less inferior than in *Pt. coregonus*. The eye, in a specimen sixteen inches long, is relatively larger than in *P. collapsus*, and about as in *Pt. coregonus*. The muzzle is less prominent than in the last named fish, but more so than in *Pt. collapsus*. The mouth is of ordinary size, but the upper lip does not form a free projecting rim as in the latter. The under lip is a narrow crescent following the boundary of the mandible, not folding so as to meet on the middle line as in the species already described.

Dorsal outline a little elevated, rays XIV.

Colors very light; the inferior fins white. In size this species is one of the largest, reaching four pounds and over. It is much valued by the people living in the neighborhood of the Catawba River, North Carolina, as an article of food. They call it the "White Mullet." I have not seen it in the Yadkin or any other river.

68. PTYCHOSTOMUS THALASSINUS, Cope.

Species nova.

This fish approaches the *Pt. collapsus*, Cope, in many respects. The head

is elongate, about one-fourth the length (exclusive of caudal fin), and is plane above. The muzzle is not very prominent, nor the mouth smaller than usual in the genus. The lower lip is quite different from that of *Pt. collapsus* in its narrow crescentic form. The eye is similar in size to that of that species. The dorsal line is elevated; dorsal radii XIV—XV. Color sea green above, white below; fins white. Reaches four or five pounds, and still greater weight.

It may be that this fish is a form of the *P. collapsus*, but the different mouth and coloration seem to separate it. Its whole proportions differ from those of *P. albus*. I have only observed it in the Yadkin River, where it is abundant, and used for food.

69. *PTYCHOSTOMUS ROBUSTUS*, Cope.

Species nova.

With this species we commence the most numerously represented section of the genus, in which the inferior lip is large and full, entirely covering the space between the rami of the mandible, and having a transverse or convex posterior margin. In this it resembles the true *Catostomi*, and diverges from the type of *Carpoides*, etc.

In *P. robustus*, we have a species, stout in all its proportions, and with marked coloration; with the gibbous or elevated dorsal outline of *P. coregonus*, it combines the short body of the *Pt. collapsus*. The head is short and deep, the muzzle not prominent, truncate in profile. Eye between four or five times in length of head. Dorsal fin short with straight superior margin, radii XII. Scales as in *P. collapsus*.

Color smoky or clouded above, mingled with golden reflections; sides similar, below yellowish. Dorsal, caudal and anal fins dark crimson. Size large. I examined one of six pounds weight.

This species is distinguished by its form and color, from all the others inhabiting the Yadkin. I did not see it in any other river area. It is highly valued for the table by the people living near the river. With the *P. thalassinus* and *T. erythrurus* var, it is taken in spring-nets. These nets are attached by four corners and suspended to the extremity of a lever whose fulcrum, as high as a man's head, is on the river bank. Bait is thrown on it, and when the fishes congregate, the land end of the lever being suddenly depressed, the suckers do not escape. If fishing were confined to this mode, and the autumn weirs not made too tight, an abundant supply of food from the rivers might be promised the State of North Carolina for future time. But unfortunately, too many of the people with the improvidence characteristic of ignorance, erect traps, for the purpose of taking the fishes as they ascend the rivers in the spring to deposit their spawn. Cart loads have thus often been caught at once, so that the supply is at the present time reduced one half in many of the principal rivers of the State. The repopulation of a river is a very different matter from its preservation, and involves much time, attention and expense. It would be far cheaper for the State of North Carolina to enact laws preservative of this important product of her waters, similar to those in force

in many of our older States. The *execution* of such laws is, however, the important point, and the destruction by officers, of the spring traps and weirs in the Neuse, Cape Fear, Yadkin and Catawba Rivers, every spring, at the time of running of the fishes, would allow of the escape of immense numbers of them, before the traps could be repaired.

70. *PTYCHOSTOMUS ERYTHURUS*, Raf.

Ichthyologia Ohiensis, p. 59. *Ptychostomus duquesnei*, Agass part. Am. Journ. Sci. Arts., XIX 90. Cope Journ. Ac. Nat. Sci., Phila., 1868, 236.

This species is probably the most widely distributed, as well as one of the largest of the genus.

The form is somewhat compressed, but the dorsal line is not much arched; the head is of medium size, entering the length 4.5 to 4.66 times. The end of the muzzle is nearly vertical in profile. The lips are full, the posterior truncate or openly emarginate posteriorly; the plicae coarse. Eye 4.5 times in length; 1.66 lines in interorbital width. Depth of body three and two-thirds times in length (exclus. caudal.) Top of head nearly plane. Scales 5—42—4. Radii D. XIII, V. 9., dorsal with straight superior outline. Color silvery, rosy and gray above; dorsal caudal and anal fins orange.

The above description is taken from one of several specimens from the Yonghiogheny River, in Western Pennsylvania. I have procured other and similar individuals from the Holston and French Broad Rivers, in Tennessee. It is, as Rafinesque observes, a most abundant sucker in all the rivers tributary to the Mississippi from the East, and is that which is known every where as "red horse." It is the common fish-food of the people, sharing the distinction with the "blue cat," *Ichthaelurus coeruleus*. It reaches as large a size as any species of the genus, and I have seen them of six and eight pounds. The largest I have heard of, was caught in the French Broad, and weighed twelve.

With various authors, I have formerly regarded it as the *Pt. duquesnei* of Lesener, but I suspect it to be distinct, as already indicated by Rafinesque. The characters of the latter are pointed out below.

A species resembling the present, as well as the *Pt. robustus*, bears the name of "red-horse," in the country of North Carolina, east of the mountains, but whether the same or not, the present inaccessibility of my specimens prevents me from deciding. A specimen from the Catawba of seven lb. weight had a relatively larger head, and was otherwise stouter than the above described. D. 1.12; scales 6—43—5. The fish is common in that river, and equally so in the Yadkin. Those from the latter have D. XII; muzzle not prominent; head and body rather elongate; shaded with yellow, particularly on sides of head; fins orange. It will be observed that the eastern fish agree in having D. 12 soft rays.

71. *PTYCHOSTOMUS LACHRYMALIS*, Cope.

Spec. nov.

This species is quite near the last, and may at some future day be shown to be only a local variety of it, but in this case *Pt. macrolepidotus* must

follow also. Its characters are very similar; our specimen differs in its more numerous scale series, a point in which the *Pt. erythrurus* agrees with all the other species with scarce an exception. I do not know of any genus where the number of scales is so similar in all the species, as in *Ptychostomus*. Scales 7—46—5, in a larger specimen, in a smaller they are 6—44—5. The cranium, however, presents us with the oblique superopercular region and elevated vertex with a ridge on each side, as in the *Pt. macrolepidotus*. The premaxillary spines and nasal cartilage also projects, leaving quite a depression across the muzzle in front of the nares, a feature not seen in *Pt. erythrurus*, and less marked in *Pt. macrolepidotus*. The mouth is quite inferior, but is large and the lips large and thick. The inferior has a slightly concave posterior margin, and the median posterior fissure is stronger than the others. The orbit is smaller than in *Pt. macrolepidotus*, and enters the interorbital space twice. Depth 3.75 times in length. The dorsal outline is gently arched, and reaches its highest point a little in advance of the dorsal fin. The latter has the superior outline but little concave, rays XII in the larger, XIII in the smaller; V. 9.

The scales of this species are as in *Pt. erythrurus*, not black at base; a trace is seen in the smaller specimen. This mark is seen in *Pt. macrolepidotus* and *Pt. crassilabris*, the latter also from the Neuse river. The fins are white.

This species reaches a length of eighteen inches. One like it is sold in the market of the city of Newbern, N. C., with a second species much resembling the *Pt. crassilabris*, but whether identical or not, I cannot be sure, as my specimens were lost.

Ptychostomus macrolepidotus. Lesueur.

Agassiz in Sillim. Amer. Journ. Sci., Arts XIX. 89. *Cutostomus macrolepidotus*, Les. Journ. Acad. Natl. Sciences I, 1817, 94 Tab.

Fusiform compressed, the depth entering the length $3\frac{2}{3}$ times; the head short, contracted anteriorly, the occipital region elevated, very convex transversely. Length of head 4.6 to 4.5 times in length; orbit large, diameter 4 to 4.3 times in length of head, and twice in interorbital width. Scales 5—45—5, radii D. XIII; V. 9. The lips are well developed, and the posterior is transverse posteriorly.

The length of the specimen described is about a foot. The color in life including fins, is white, yellow shaded above.

Ten specimens have been compared, all from Pennsylvania and Delaware. Of five from the Conestoga Creek, a tributary of the Susquehanna, two have the parietal, median frontal, and nasal bony ridges very prominent, while in two they are almost without trace. In the former the dorsal radii are XIII, in the latter XII. I cannot discover the sexes of these specimens as they have been eviscerated. In the other five there are several with weak crests, but none with XII D. rays.

In a large specimen from the Wabash River, the only departure from the typical form is the more emarginate inferior lip.

This species is especially abundant in the comparatively sluggish streams

of Maryland and Delaware, and is but little valued for market. It is no doubt the species described first by Lesueur, as it is the only one of the genus seen in the Philadelphia market. I did not meet with it in North Carolina.

Ptychostomus duquesnei, Lesueur.

A specimen of this fish from near Pittsburg, Lesueur's original locality suggests the correctness of the opinion of Rafinesque, that his *Pt. erythrurus* is a different species. The characters are seen in the 10 ventral radii, and the considerably more prominent muzzle, with correspondingly inferior mouth. The scales are also smaller 7—48—7, (to front of ventral). Dorsal fin little incised above, R. XIII. Length of head 4.6 in that of head and body; orbit four times in head 1.75 times in interorbital space. Cranial crests moderate, the parietal region elevated as in *Pt. macrolepidotus*, not so plane as in *Pt. erythrurus*. Depth $3\frac{2}{3}$ in length. Lips moderately developed. Dentition as in *Pt. erythrurus*. The coloration in spirits is quite like that of other species, except that the dorsal region is a dark steel bluish, which the other species do not exhibit. Scales without black spot at base.

Length of a moderate specimen from the Youghiogheny River, Pennsylvania, one foot.

Kirtland's description in Proc. Boston Sci. Nat. Hist. V 268, leaves it somewhat uncertain as to whether this species or the *Pt. erythrurus* was before him; his figures resembles the present fish. I should not be surprised to find that his female "red-horse" described as so different from the male, was our *Pt. collapsus*.

Ptychostomus carpio, C. V.

This species differs from its near allies in the more numerous dorsal radii, etc. The form appears to be that of *Pt. erythrurus*. Its habitat is given by the French authors, as Lake Superior, and Günther adds St. Lawrence River and Lake Erie. I have not seen it. The lip characters separate it from *Pt. velatus*.

Ptychostomus oneida. Dekay.

Geological survey, New York, III, 189.

This species is also similar in general proportions to the *Pt. erythrurus*, but has, according to Dekay, more numerous scales and a much smaller eye. Dekay says: seventeen longitudinal rows of scales counted at dorsal fin. Head and body 10 in.; tail 2.; head 2.5 (one-fourth); eye., 4 inch (one-sixth head). Radi D. XIII; V. 9. He does not describe the lips.

Oneida Lake.

Ptychostomus aureolus. Les.

Agass. l. c. 89. *Catostomus aureolus*. Lesueur J. A. N. Sci. Phila. I, 95 Tab.

With this species we enter a series characterized by the relatively small size the head bears to the body, and consequent apparent elevation of the latter. The head enters the length exclusive of the caudal fin, five times.

This species resembles the *Pt. macrolepidotus* Les., more than it does the *Pt. erythrusus*, but the proportionate size of the head is less. In a specimen 8 inches long, the scales are 6—49—4; radii D. XIII, V. IX. The supraoccipital region is much elevated and convex, the interorbital region convex, but without keel. The muzzle is prominent, and separated on the upper surface by a deep transverse depression. The mouth is but little overpassed by the muzzle, and is large. The lips are rather narrow. Eyes five times in length, 2.5 times in interorbital breadth of head.

I do not recollect the colors of this sucker in life; Lesueur states the fish to be orange above, bases of scales darker; inferior fins red.

A single specimen from Saginaw Bay, Lake Huron, has furnished me with means of comparison. It agrees exactly with Lesueur's account of it. The basis of the scales of some dorsal series are blackish. The species is supposed to be confined to the Great Lakes.

Ptychostomus sueurii. Rich.

Catostomus sueurii, Richardson Fr. Journ. 1823, 772. Fauna Boreali Americana III, 118.

This species appears to me to be very near the last, and agrees with it in proportions of head to body, of depth, fin radii, squamation, etc. He says, however, that the muzzle projects an inch beyond the mouth, in a specimen nineteen inches long, which is certainly not the case in the species last described. Hence I suspect it to be distinct, and that it will be found to possess other characters when re-examined. Gunther, (Catal. Brit. Mus.) refers it to the *C. macrolepidotus*, to which it is evidently nearly allied.

From the Fur countries, British North America.

72. *PTYCHOSTOMUS CRASSILABRIS*, Cope.

Species nova.

This sucker is near the *Pt. aureolus*, but has a more contracted conic muzzle, and smaller mouth; it is also a flatter and more clupeiform fish. Supra-occipital region elevated, convex; orbit 4.2 in length of head, 2 times in interorbital width. Depth 3.75 times in length. Scales large, 5—44—5. D. XII; V. 9. Length of specimen described, one foot.

Color in life silver, above with a smoky shading, and the scales black at the bases. Dorsal fin blackish, inferior fins white. Top of head blackish; a black band from occiput to pectoral fin.

The lips of this species are thick, the lower truncate, but the mouth is very small. In these features it is between *P. conus* and *P. aureolus*. The dorsal fin in the specimen described is elevated in front, the basis being only .75 the first soft ray, in length. The margin is deeply concave. The fewer dorsal radii, as well as the less prominent muzzle, distinguish it from *Pt. conus*.

From the Neuse River, near Raleigh, N. Ca.

Ptychostomus breviceps, Cope.*Species nova.*

An elongate species with small head, and very convex occipital region, characterized by the presence of X ventral radii.

Depth .25 the length; orbit 3.75 in head, 1.75 in interorbital width. Cranial ridges not strong. Basis of dorsal five-sixths the anterior height, radii XIII; free margin deeply concave. Body compressed, dorsal line very narrow. Scales 6—45—5. Muzzle short conic, projecting beyond mouth. Lateral small, lips short, the posterior well developed, not emarginate.

Color white, yellowish below; scales above with a little black at their bases.

Length of specimen examined, ten inches.

This fish belongs to the basin of the Ohio. I have a specimen from the Yonghiogheny. The number of the ventral radii is very constant in this genus, but if the increased number should prove to be accidental, the general characters of this fish would approximate it to *Pt. aureolus*.

A peculiarity of the type specimen consists in an additional ray in the anal fin—eight instead of seven in the other species, and the alteration of the third and fifth to perfectly simple, unbranched rays, scarcely attaining the edge of the fin. This may be abnormal.

73. *PTYCHOSTOMUS CONUS*, Cope.*Species nova.*

This fish represents the *P. coregonus* in the section of the genus with fully developed lips.

Form flat, with elevated dorsal line, and small conic head. D. radii always XIV. Eye large, mouth exceedingly small, far overpassed by the conic muzzle. The superior regions are smoky and the scales with black bases; below, with the inferior fins, white. Dorsal fin dusky.

The lips of this species are smaller than in *Pt. crassilabris*, though the inferior is similarly truncate behind. The muzzle is much more conic and produced than in that fish. The dorsal radii are more numerous.

Numerous specimens from the Yadkin River, North Carolina, where it is taken in large numbers with *Pt. collapsus*, *Pt. robustus*, etc., but is of less value than they.

74. *PTYCHOSTOMUS CERVINUS*, Cope.

Journ. Acad. Nat. Sci., Phila. 1868, 235, Tab. iii, fig. 4.

This species constitutes a well marked section of the genus, characterized by a cylindric form, the transverse diameter of the body being equal to the vertical. Before describing this species in detail, I may premise that I have found no little difficulty in attempting to identify the *Pt. melanops*, Raf., of Dr. Kirtland's fishes of the Ohio. The figure resembles the *Pt. crassilabris* very closely, but the description of "body full, cylindric," will not allow of the identification. Should the fin formula of *Pt. breviceps* be abnormal, the compressed body and lack of spots point to specific diversity. I had thought the present species intended, but the

figure given by Kirtland precludes the idea, for the *P. cervinus* is in form much like the *Catostomus nigricans*, and has a much less elevated dorsal region than the *Pt. melanops*. It differs also in the form of the dorsal fin, which in that species displays XI XII D. radii instead of XIII. For the present, therefore, I introduce the *Pt. melanops* by name only.

Head of *Pt. cervinus* one-fifth the length, as broad as deep, plane above. Muzzle truncate, low in profile, lips large, the superior pendent. The inferior lip thick, more produced than in any other species, and with a median longitudinal fissure, the plicæ are more or less broken up. Body sub-cylindric, scales large. Dorsal short, radii XII, margin straight. Above yellowish brown, below yellow; fins not red. The dark of the upper surfaces often forming broad transverse shades. After death the colors above become a dark emerald green. This fish never exceeds a foot in length, and rarely attains that size. It exists in great numbers in the Catawba River, but I did not meet with it in the Yadkin or elsewhere. It has a peculiar habit of leaping from the water, whence the fishermen call it "jumping mullet." It is but little valued as food, though many specimens are caught on the weirs.

Also from the Roanoke River in North Carolina and Virginia, and the James in Virginia.

Günther again confounds this species, so well known to the fishermen of the Southern rivers, with the *Pt. duquesnei*.

CARPIODES, Rafinesque.

Agassiz, Am. J. Sci. Arts, XIV, 74, 1865.

The species of this genus are extensively distributed in the fresh waters of North America, east of the Rocky Mountains. I am not acquainted with any from the Atlantic streams to the eastward of the Delaware, though they may exist, while they are found in the Great Lakes and the tributaries of the St. Lawrence. Agassiz defined this genus as above, and indicated four species, one described by Lesueur, one by Rafinesque, and two by himself. I have not seen specimens from the Eastern waters of North Carolina, though they no doubt exist, while they are also abundant in the French Broad and other tributaries of the Tennessee. My specimens of those from the latter being lost, I give an account of other species known to me. I add five to the four already known.

I. Anterior rays of the dorsal fin very much elevated and attenuated, exceeding or equalling the length of its basis.

a The muzzle very abruptly obtuse.

Anterior suborbital much deeper than long; anterior margin upper lip below orbit.

C. DIFFORMIS.

Anterior suborbital similar; upper lip before nares; eye 4.6 times in head.

C. CUTISANSERINUS.

Anterior suborbital sub-triangular, longer than deep; upper lips before nares; eye 3.6 times in head.

C. SELENE.

aa The muzzle conic, projecting.

Size medium, back elevated.

C. VELIFER.

II. Anterior rays shorter, measuring the anterior half or a little more of the base of the dorsal; (muzzle conic or projecting).

D. XXIV. A. VII. Depth $2\frac{5}{8}$ in length; head 4.3 in same; back much elevated, anterior dorsal rays measure to the 15th ray.

C. GRAYI.

D. XXVIII, V. X. A. VII. Depth 2.5 in length; head 4.25 in snout; scales 8-5; short, stout; long dorsal rays measure to 22 ray.

C. THOMPSONI.

D. XXVI-VII, V. X. Depth 3 times in length, head 3.5 times; muzzle elongate conic; eye median, large; anterior D. rays not thickened, nearly as long as base of fin.

C. BISON.

D. XXVII to XXX; A. VIII; scales 6-5; oblong, long dorsals to 22 ray in adults; depth 2.7 in length, eye small anterior.

C. CYPRINUS.

D. XXX A. VII; anterior dorsal rays thickened, osseous, short, reaching 16th ray; head small, 4.5 to 5 times in length; eye small anterior; fusiform, depth 3 times in length.

C. NUMMIFER.

In the number of the radii of the ventral and anal fins, the species are not always entirely constant; thus in one, *C. bison* there are VI, in another VII anals. In *C. cyprinus* some have IX and others X ventrals. In young examples of the species just named, the long anterior dorsal rays are longer than in the adult, but not so much so as to be confounded with the long rayed species of section one. The margins of the scales in this genus and *Bubalichthys* are serrate, their structure thicker than in the *Ptychostomi*.

Gill has adopted the genera of the *Catostomi* as left by Agassiz, while Günther rejects most of them. *Moxostoma*, *Ptychostomus* and *Catostomus* I regard as distinct genera of the typical form, to which I add *Placopharynx*. Of those with finer and more numerous pharyngeal teeth, *Cycleptus* is distinct in its completely ossified cranium, as I have pointed out in an essay on the *Cyprinidæ* of Pennsylvania. *Bubalichthys* is well characterized by the form of its pharyngeal bones, as shown by Agassiz. The remaining Rafinesquian genera, *Carpiodes* and *Ichthyobus* are but doubtfully distinct from one another. *Carpiodes* is the older name, with which *Sclerognathus*, Cuv., Val., may be associated as a synonyme.

Carpiodes difformis, Cope.

Spec. nov.

This species has a remarkably obtuse muzzle, which with the large eye, almost gives it the appearance presented by monstrous perch and carp where the premaxillary bones are atrophied. Viewing the top of the head from a position opposite a point mid-way between the dorsal fin and end of the muzzle, the spine of the premaxillary bone is not visible. In the *C. selene* these spines are very distinctly prominent, in the *C. cutisanserinus* slightly so.

The dorsal outline of this fish is arched, elevated to the anterior dorsal radii, and then regularly descending. The long dorsal rays extended, reach to beyond the origin of the caudal. Lateral line nearly straight,

scales 6—35—4. The end of the pectoral is in line with the origin of the first dorsal ray. Radii, D. XXIV, A. VIII, V. IX.

The head is very obtuse and has a very large eye, beyond whose anterior rim the extremity of the nasals project but a little way. The spines of the premaxillaries project upwards and forwards, but not so far as the line of the nasals, and fail by .25 inch of reaching the line of the inferior rim of the orbits. The anterior edge of the mandible is in line with the anterior rim of the orbit, and the end of the thin upper lip reaches the line of the anterior rim of the pupil.

The diameter of the eye enters the length of the head 3.6 times, and the length of the head the total (exclus. caudal) 4.22 times. Opercle radiate-ridged. Supraoccipital region much elevated, with lateral ridges. Anterior suborbital trapezoid, deeper than long. The size of this species is medium; average length, one foot. The color is uniform brownish golden.

From the Wabash River in Indiana.

Carpiodes cutisanserinus, Cope.

Species nova.

This species is near the last, but present various distinctive features. These may be summed up as follows:

The dorsal fin originates mid-way between end of muzzle and basis of caudal fin—considerably nearer end of muzzle in *C. difformis*. The eye is smaller, 4.5 times in length of head. The spines of the premaxillaries project considerably in advance of the line of the nasal bones, and reach the line of the lower rim of the orbit. The upper lip is much in advance of the orbit, and the end of the same barely reaches the line of the anterior rim of the latter. Scales 7—37—5. Anterior suborbital bone vertical ovate.

The lips are minutely tuberculate. Operculum and suboperculum rugose, former radiate. Long rays of dorsal and anal extending a little beyond the basis of the caudal fin. Head four times in length head and body. Depth 2.6 in the same. Length, a foot; color silvery. In a male in spring, the muzzle and front are covered with closely set small papillose corneous excrescences. Radii D. XXVI, V. X, A. VIII.

From the Kiskiminitas River, Western Pennsylvania.

Carpiodes selene, Cope.

Species nova.

Anterior dorsal outline steeply elevated, also the supraoccipital region, vortex convex above middle of orbit, concave above anterior rim of same, as in the two preceding species. The present fish is intermediate in many ways between the two last, and adds characters of its own. Thus the anterior suborbital bone is longer than in either, longer than high, and narrowed posteriorly. The orbit is large as in *C. difformis*, entering the length of the head 3.6 times, while the muzzle is more elongate than in either. The head is narrowed vertically; the spines of the premaxillaries extend beyond the nasal crests, but do not quite reach the plane of the

lower limbs of the orbit. The premaxillary border is far in advance of the orbit, and the extremity of the maxillary attains the anterior rim of the orbit. Dorsal and caudal radii extended, reach the basis of the caudal; the origin of the first is equidistant between the latter point and the end of the muzzle. Rays; D. XXVI; V. 10. A. VIII. Scales 7—37—5. Color silvery white. Length, a foot. Three specimens of this were taken in the Root River, Michigan, in all probability, though the label which accompanied them has disappeared.

Carpiodes velifer, Rafinesque.

Catostomus, Sp.? Lesueur Journ. Acad. Nat. Sci. Phila. I 110. *C. velifer* Raf. Ichth. Chiensis 56 *Sclerognathus cyprinus* "Val." Kirtland Fishes of the Ohio. Proc. Bos. N. H. Soc. V. 275 Tab. XXII fig. 2 not of Valenciennes.

I have referred my specimens to this species chiefly on the strength of the figure and description of Prof. Kirtland, and from the fact that Lesueur regarded it as so near the *C. cyprinus*, which he would not have done with the *C. cutisanus* of the Ohio before him. I had two specimens of the present fish, one of them from the Wabash.

It has a shorter dorsal fin than the preceding, having but XXII rays, of which the anterior two are exceedingly elongate. The prominence of the muzzle is the most distinctive feature; it is conic, the spines of the premaxillaries projecting at an angle of 45° to beyond the nasal crests, and the extremity not reaching the line of the lower rim of the orbit. The extremity of the mandible extends to the nares. Eye 4.25 in length of head. Head 3.75 in length; depth 2.4 in the same. Scales as in the last species. Second suborbital long as deep, trapezoidal. Origin of dorsal .2 nearer end of muzzle than basis of caudal. Length of type specimen ten inches.

Rafinesque says that this species is called skip-jack, from its habit of throwing itself from the water, and sailor, from its elevated dorsal fin which appears above the surface of the water. The first mentioned name is also applied to a clupeoid of the same streams, the *Pomolobus chrysochloris*. Raf. Kirtland says the present species is not much valued as food.

Carpiodes grayi, Cope.

Spec. nov.

In this fish we have the form and proportions of the last group, with the shortened dorsal radii of the succeeding forms.

The origin of the first dorsal radii is nearer the end of the muzzle than the origin of the caudal by one-fourth of its basis. This embraces XXIV radii. Anal radii just to base of caudal. Orbit .25 the length of the head; interorbital width 1 3-5 the former. Occipital region elevated; muzzle much prolonged conic, mouth posterior, as in *C. velifer*. In general this species is quite near the latter; the number of scales is the same, and the proportions quite similar. The orbit is not so elevated, and the long dorsal radii about half as long as those of that species. Length of type eight

inches. Locality not well ascertained, but as it accompanied species of *Bubalichthys*, it is probably from one of the western States.

Dedicated to my friend, Dr. John Edw. Gray, for many years the energetic director of the zoological department of British Museum.

Carpiodes thompsoni, Agass.

Amer. Journ. Sci. Arts, XIX 75. *Catostomus cyprinus* Thompson, Nat. Hist. Vermont. *Sclerognathus cyprinus* pas Kirtland, Fishes of Ohio, Proc. Bost. N. H. Soc. V. 275.

This is perhaps the handsomest species of the genus, and is distinguished by its stout form, numerous narrowly exposed scales, and little elevated dorsal fin. The eye is small, entering the length of the head 5.2 times, and 2.2 times the interorbital width. The muzzle is more elongate, but not so conic as in the two species last described, and projects far beyond the nasal crests, having an obliquely truncate profile. Hence the end of symphysis mandibuli is much in advance of the line of the nares, and the rim of the upper lip just reaches the line of the orbit.

Dorsal line much arched, origin of first dorsal radii midway between end of muzzle and origin of tail. Scales 8—41—6. V. 10, A. VII. Operculum flat, slightly ridged. Length averaging a foot. Color silvery, with a greenish golden band along the middle of each of the series of scales near the dorsal region, producing longitudinal golden bands.

Specimens from Lake George and Saginaw Bay, Lake Huron.

Carpiodes bison, Agass.

Amer. Journ. Sci. Arts, XVII, 356.

The original description of this species is rather too brief to allow of a perfectly satisfactory determination of my specimens. These are from the Wabash, in Tennessee; those described by Prof. Agassiz are from the Osage, in Missouri.

This species has the general form of the buffalo fish, but has not so elevated a dorsal outline. It is therefore, much less elevated than the *Carpiodes* above described. It is especially characterized by the elongate form of the muzzle, in which it exceeds any other species of the genus. The profile descends obliquely posteriorly from the end of the muzzle to the mouth, and the end of the mandible is but little in advance of the nares, while the canthus is in line with the anterior limb of the orbit. The lips are well developed for the genus, and delicately longitudinally plicate. The eye is large, the middle line of the cranium falling within its posterior rim; in other species it falls posterior to this point. Its diameter enters the length of the head 4.5 times, and the interorbital width, twice. Scales 7—40—5. Pectoral fin barely reaching line of anterior dorsal ray. Caudal furcate half its length.

In general proportions this fish is a good deal like the European carp. The occipital region is elevated and narrowly convex. The long dorsal ray is almost as well developed as in the species of group first, extending

nearly to the end of the fin in one specimen .75 the distance in another. Color, brownish golden. Length, one foot.

75. *CARPIODES CYPRINUS*, Lesueur.

Catostomus do., Lesueur, Journ. Ac. Nat. Sci. Phil. I, 91, Tab. *Carpiodes*, Agassiz, l. c. Günther, Cat. Brit. Mus. VII, 24. *Carpiodes vacca*, Agass., l. c.

This is another elongate species with shorter dorsal radii, and rather large scales. In six small specimens there are 7 rows above the lateral line, and in two young and one adult, six. Length of head $3\frac{3}{5}$ times in length same and body; eye small, .25 times in interorbital width, nearly six times in head in adult of a foot in length, 4.5 times in young of five inches. Muzzle quite prominent, but obtuse. Front scarcely concave between orbits or in front of nasals, (thus differing from most of the other species). End of mandible extending beyond line of nares. Lips faintly plicate. Supraoccipital region elevated, little ridged. Anterior dorsal rays midway between origin of caudal and end of muzzle. Color silvery, dorsal fin black, paired fins white-margined.

Common in the tributaries of the Chesapeake and Potomac, rare in those of the Delaware in Pennsylvania.

C. damalis, Gird., from the Platte R., is very near this species.

Carpiodes nummifer, Cope.

Species nova.

The largest species of the genus, from the Wabash River, Indiana.

The detailed characters have been given in the synopsis of the species. The form is characterized by elongation, and the small proportions of the head. The body is compressed, and the dorsal line elevated to the first dorsal ray, which is considerably nearer the end of the muzzle than the origin of the caudal fin. Its rays are more numerous and the anterior shorter than in any other species here enumerated. The bony and first cartilaginous rays are stouter than in any other species, the latter presents no segmentation on the surface for the basal half.

The orbits are more anterior than in other low-finned *Carpiodes*, the middle line of the cranium falling .25 inch behind the orbit in a specimen of 20 inches length. Diameter 4.6 in head, nearly twice in interorbital width. Scales 7—36—5. Muzzle short, rather obtuse but projecting much beyond mouth. Symphysis mandibuli extending to nares.

Color of scales an olive silver or nickel color, whence the name *nummifer*, money-bearer. Sides of head yellow. Length 18 and twenty-four inches at least. Wabash River, Indiana; three specimens.

NOTURUS, Rafinesque.

76. *NOTURUS MARGINATUS*, Baird.

From the Catawba and Yadkin rivers.

AMIURUS, Raf., Gill.

This genus is by far the most numerously represented by species among the Siluroids of the United States. Twenty-five are known to the writer, and several others have been described which are not satisfactorily distinguished. Besides the United States, China is included in the range of the genus. In North America they are a most noticeable feature of the ichthyological fauna of the Eastern Coast Streams, abounding there in individuals and species, far more than in the tributaries of the Mississippi, where Ictalurus is the prevailing form. The tributaries of the Great Lakes furnish another resort for them, and the rivers of Texas, according to Girard, also abound in them. This distribution in relation to Ictalurus is to be found in the fact that they are lovers of mud and sluggish waters, while the latter genus prefers running streams and rivers.

The species of Amiurus fall into four sections as follows:

I. Caudal fin rounded or truncate when spread open.

A The anal radii few, 17-22.

a Body slender, depth 1-8 length.

Anal radii 17; eye rather large.

A. PLATYCEPHALUS.

aa Body stouter; depth 1-5 or less length.

β Lower jaw longer than upper.

Anal radii 20, its basis 5.5-6. times in length; head narrowed anteriorly, body not shortened.

A. DEKAYI.

A. 22, head broad, body short.

A. ŒLURUS.

ββ Upper jaw equal or exceeding lower.

* Anal radii 17.

A. PULLUS.

** Anal radii 19-22.

† Ventral radii 8.

Head width 4.5 to 4.66 times in length; diameter eye 4.5 times between orbits; depth 3.75 in length, beards rather short, humeral process smooth.

A. NEBULOSUS.

Width head four times in length, depth 3.66 times; eyes 4.5 between orbits; colors light; beards as above.

A. CATULUS.

Width head 4 times in length; eye 4; other characters as above; colors dark.

A. CATULUS, var.*

†† Ventral radii 7.

Eye larger, 3.75 times into interorbital width; head narrowed, width 4.66 times in length; black.

A. MISPELLIENSIS.

A.A The anal fin longer, the radii 24-8.

To this group belong *A. cupreus*, Raf., *A. cupreoides*, Gird., *A. atrarius*, DeK., *A. catus*, Linn., *A. nigricans*, Les., *A. cœnosus*, Rich'n., *A. felinus* and *A. antoniensis* of Girard.

II. Caudal fin furcate or strongly emarginate.

A Anal fin with few radii, (19-22).

a Caudal fin merely emarginate.

* I refer a specimen which I took at Poughkeepsie on the Hudson River, to this species.

Head less than one-fourth length. A. 20; eye 4.5 times between orbits; dorsal nearer adipose fin than muzzle. A. CONFINIS.

Head as above; orbit 4 times between orbits; A. 23; dorsal nearer muzzle than adipose fin. A. HOYI.

aa Caudal furcate.

Width of head from 4.6 times in length; eye large, 3 to 5 times in inter-orbital space; barbels long; caudal fin deeply forked. A. LYNX.

Head very wide, width 3.6 times in length; eye six times between orbits, barbels very short, caudal not deeply furcate. A. LOPHIUS.

AA Anal fin large; radii 24.5.

Caudal emarginate; pectoral spine not denticulate; barbels reaching gill opening; head wide as long. A. BOREALIS.

Caudal deeply furcate; head narrow, pectoral spine dentate, barbels to end of humeral process. A. NIVEIVENTER.

Of other species of the genus, I have omitted *A. puma* Gird. *A. natalis* Les., and *A. felis* Agass, all belonging to section I, owing to the imperfections in the descriptions. *A. albidus* Lesueur, is, I think, founded on adults of *A. nebulosus* Les. *A. obesus* Gill of which I have examined numerous specimens from Minnesota, two from the Miami, Ohio, and one from the Kiskiminitas River, in West Pennsylvania, I cannot distinguish from *A. catulus* Girard (U. S. Pac. R. R. Rept. X). Of species adopted, *A. catulus* Girard, may be found eventually to be varieties of *A. nebulosus*. The *A. mispilliensis*, *A. lophius* and *A. niveiventris*, are now described for the first time.

77. AMIURUS PLATYCEPHALUS, Girard.

Proc. Ac. Nat. Sci. Phila. 1859, 160.

This well marked species approaches nearer the genus *Hopladelus* than any other *Amiurus* in its elongate, flattened body and head, and in the large number (11) of its branchiostegal radii. It abounds in the Catawba and Yadkin Rivers, where it is justly valued as an article of food.

Amiurus mispilliensis, Cope.

Spec. nov.

This species is related to the common *A. nebulosus*, but has a narrow muzzle, larger eyes and a ventral ray less than any other species of the section. Width of head 4.66 times in length; eye 3.25 times between orbits, maxillary beard extending beyond base of pectoral fins. Pectoral spine dentate, dorsal spine smooth. DI. 6; V. 1.6; A. 21. Above entirely black; below, white anterior to anal fin. The mental barbels blackish. The maxillary barbels extend to beyond base of pectoral fin, and the mentals to the branchiostegal margin. Entire length 8 in.; depth 1 in. 8 lines.

I took this specimen in the Mispillion Creek, a sluggish stream in the southern part of the State of Delaware. It doubtless occurs in similar streams in "the Peninsula."

78. AMIURUS LYNX,* Girard.

This is a variable species in the size of the orbits and width of the head. In the younger of six inches in length, the diameter of the former is contained in the interorbital space three times; in specimens of 9.5 inches four times; up to this size the width of the head enters the length without the caudal 4.5 times. Between this size and eleven inches the width of the head varies from 4.5 to four times; the orbit being one-fifth the frontal width in those of larger size. This is the greatest relative width of head I have seen in this species. The upper jaw always projects below the upper, the humeral process is always rugose and swollen proximally, and the maxillary barbels pale edged below.

The younger forms described, are the *Ictalurus keviniskii* of Stauffer, (Mombert's History of Lancaster County, Pa., 1869, 578). The following description applies to such.

It has the narrow head, large eye and furcate tail of *Ictalurus*. The dorsal spine is nearly smooth, other rays 6; A. 22; V. 8; C. VI—17—VII. The depth enters the length times. The largest specimen of this species I have seen does not exceed eight inches in length. The color above is a lively brown, sometimes tinged with purple; sides silvery, belly silver white.

The larger form with relatively smaller eye is *I. macaskeyi*, Stauffer, of the same work. The same form I took in the Mispillion Creek, Delaware. It differs from old examples of the latter in its more slender form, the width of the head entering the length 4.66 times between orbits; barbels and color as in *A. lynx*. Specimens intermediate in character between this and the wider-headed form served as Girard's types. They were from the Potomac. Two specimens in my possession from that river have the with head 4.25 times in length, eye 4—4.5 times between orbits; long maxillary, short mental barbels; dorsal nearly equidistant between muzzle and adipose; humeral process swollen, rugose.

One specimen from the Susquehanna exhibits the width of the head one-fourth the length, as above mentioned. This renders the distinction of Girard's *A. vulpeculus*, questionable, since the only essential characters he mentions are the following:

Head 4 times; orbit $\frac{1}{4}$; caudal 6.5 times in length, dorsal nearer muzzle than adipose fin.

I have seen many specimens of this cat-fish from the Conestoga Creek, from the Susquehanna, and from the Delaware, in Pennsylvania.

Some specimens which I obtained at Newberne, on the Neuse River, were lost, but I suspect them to have been this species. As it is common in the James River, it probably occurs also in the Roanoke.

Amiurus lophius, Cope.

Species nova.

This, perhaps the largest species of the genus, is distinguished by the

* In Origin of Genera, 43, I state that the *Gronias nigrilabris* Cope resembles the *Amiurus lynx* most closely among the *Amiuri*. This is an error; the comparison should be made with *A. nebulosus*, from which the form of the anal fin, short barbels, etc., distinguish it.

greater width of its head, and the gape of the mouth, together with the decided but shallow furcation of the caudal fin. The barbels are considerably shorter than in any other species of the fork-tailed section.

Head and dorsal region very flat, the width of the former contained 3.5 times in the length of the body and head, and the length of the same entering the same three times. The depth at the first dorsal ray, enters the same 5.4 times. That ray is exactly intermediate between the end of the muzzle and the posterior margin of the base of the adipose, having thus a more posterior position than in *A. lynx*, where it measures the middle of a line terminating at the anterior base of that fin. The free extremity of the adipose is in line with the same of the anal. Radii D I. 6; A. II. 19; V. 8. The eye is small, its long diameter entering the length of the head, measured on the middle line above, seven times, and six times in interorbital space. Pectoral spine weakly; dorsal not, serrate. Humeral process strongly rugose to near extremity.

Maxillary barbel reaching two-thirds to three-fourths the distance from its base to the upper part of the branchial slit, the outer only half way to the branchiostegal margin, the inner three-fourths the length of the outer. The extremity of the muzzle is regularly rounded, the upper jaw projecting a little beyond the upper. Branchiostegal rays nine. Total length eighteen inches; length dorsal spine 18 lin.; do. pectoral spine 18 lin.; do. basis of anal 35 lin.; width of head 53 l.

Color above brown; lower surfaces, including lower lip, (yellow or) white in alcohol; mental beards white.

This species is nearest the *A. lynx*, Girard, which inhabits the same rivers, but is readily distinguished as above pointed out, and in additionally, by the shorter barbels and lower body. In the width of its gape it exceeds any other North American cat-fish, and will allow of a remote comparison with *Lophius* in this respect.

I obtained three specimens in the Washington, D. C. market, which came from the lower course of the Potomac river. It occurs in the other tributaries of the Chesapeake Bay, and I think I have seen it in the market of Baltimore. I have not yet observed it in Philadelphia. In the former cities it is deservedly esteemed for the table, and is more valuable than the *A. lynx* and *A. nebulosus*, on account of its superior size.

The last named fish is sold in Philadelphia and neighborhood. It often attains a foot in length. I cannot distinguish the *Pim. albidus*, Lesueur. Pale and piebald varieties of the fish occur.

79. AMIURUS NIVEIVENTRIS, Cope.

Spec. nov.

This fish presents a great contrast to the last, resembling in fact the *Ictalurus cœrulescens*, Raf., in its slender proportions.

Width of head 4.75 times in length, exclusive of caudal fin. Orbit nearly four times into interorbital width. Depth 5.22 in length as above. Dorsal spine three inches from end muzzle, 3.5 inches from origin adipose fin; its posterior margin with a concealed serration. Pectoral spine strongly

serrate. Radii D 1. 6; A. 24; V. 8. Maxillary barbel to near end of humeral process; latter very rugose to near extremity. Outer mental barbel to branchiostegal margin. Br. rays ix.

Color above blackish, sides silvery leaden blue; below, including margin of upper lip and outer margin of maxillary barbels, pure white. Fins edged with dusky. Length of specimens 8.5 inches.

From the Neuse River, N. Ca.

In this species, as in all the fork-tailed Amiuri here described, the lower lobe of the caudal fin is wider than the superior. The young of these species, at least in and *A. lynx*, are much more silvery than the adult, as is the case with some of the Ictaluri.

In concluding my observations on this genus, I may add that I took *A. cupreus* in the Clinch River, in Tennessee.

ICTALURUS, Raf.

Gill emend.

80. ICTALURUS CÆRULESCENS, Raf.

This species abounds in the French Broad and other tributaries of the Tennessee, as it does in those of the Ohio. It is everywhere much used as food, though in my estimation inferior to the large Amiuri of the East, for though the flesh is whiter, it is drier.

SALMO, Linn.

81. SALMO FONTINALIS, Mitch.

This species is found in the rapid streams in which the tributaries of the Tennessee and Catawba Rivers head, in the highest tracts of the Allegheny Mountain Region. I only took them in one of the heads of the French Broad, where the size was much inferior to that of trout from similar localities in Pennsylvania. The experience of other fishermen in this respect was similar to my own. According to Dr. Hardy, a naturalist long resident in Asheville, well known to the old generation of students South and North, this fish occurs in the headwaters of the Chattoohoochee, on the south slope of the Alleghenies, in Georgia. This is the first authentic instance of its occurrence in any water flowing directly into the Gulf of Mexico, with which I have met. From the habits of the species it is hardly to be looked for in any other of the Gulf streams eastward of the Mississippi. According to Dr. Peck, of Mossy Creek, Tennessee, it is not found in the Cumberland Mountains. I did not find it there in the heads of the Cumberland or Clinch.

OSMERUS, Artedi.

Although I am not informed as to the occurrence of any species of this genus on the coast or in the rivers of North Carolina, I introduce it here for the purpose of illustrating some species which have been placed in my hands by my friend, Dr. Chas. C. Abbott, of Trenton, N. J. These were procured and forwarded to him at his request, by Chas. G. Atkins, the efficient Commissioner of Fisheries of the State of Maine, whose authority

is here given for the notes on their habits and places of abode, appended. Interest attaches to the fact that the greater part of the fishes are derived from the fresh waters of that State, and that species of this genus, like those of the other Salmonoid genera, *Coregonus* and *Salmo*, are proven to have a lacustrine distribution in the northern part of the United States.

Land-locked *Osmeri* occur in the lakes of Norway. According to Professor Esmark of Christiana, they are found in Lake Mjosen, which is 500 feet above the sea, and discharges into it by a stream which has a very high fall; also in Nors Vandsjö, near the town of Moss, and in the Stinksild.

I find three species among our lake smelt, as follows:

Eye large, one-third length of head; head short, 4.25 times in length; scales, l. long. 66; l. transv. 10. O. SPECTRUM.

Eye smaller, 4.5 times in head; head shorter, 4.75 in total; scales smaller, l. long. 68; l. transv. 16. O. ABBOTTII.

Eye 4—4.25; head 4, longer; scales, l. long. 65–7; l. transv. 13 (14).

O. VIRIDESCENS.

Osmerus spectrum, Cope.

Species nova; smelt of Wilton.

Established on two specimens sent from the above locality in Franklin Co., Maine. Form slender, the head short, with remarkably large eye, and short mouth and maxillary bones. Mandible prominent when closed, as in *O. viridescens*, the end of the maxillary bone not extending beyond the line of the middle of the pupil. Both the length of the muzzle and the interorbital width are considerably less than the diameter of the orbit. The form of the body is more slender than in the *O. viridescens*, the depth entering the length without caudal fin, 8.33 times. Radii D. 10. A. 1. 15. V. 8. The pectorals extend $\frac{3}{8}$ the distance to the base of the ventrals. Length of a medium sized specimen, 3 in. 6 lin. Scales in about as many transverse, but several fewer longitudinal series than in the other species.

Color probably translucent in life, a silver band along the upper part of the sides. Side of head and operculum silver. Top of head, middle dorsal line and caudal fin so thickly punctate with black as to be colored.

Wilton Pond is near the head of the south-west branch of the Kennebec River in S. W. Maine. The characteristics of this species, according to Commissioner Atkins, are seen in specimens of larger size than those here described, which were taken in breeding condition.

Osmerus abbottii, Cope.

Species nova.

This fish is in general characters more like the *O. viridescens* than the last; it is similar in the size of the orbit and posterior prolongation of the maxillary bone, but the scales are more numerous and the head is shorter. Like the last, it is considerably smaller than the common smelt.

The depth enters the length without caudal fin, seven times; the head the same, 4.75 times. The orbit is less than the length of the muzzle, and scarcely equal to the interorbital width. The maxillary is delicately

toothed, and reaches the line of the posterior margin of the pupil. The pectoral measures half the distance to the base of the ventral. There are five specimens of this fish, which measure about four inches in length, and they are stated in the accompanying notes to be of medium size. The colors, like those of *O. spectrum*, are darker than those of *O. viridescens*, in spirits. The median line above is dusted with black, and the lateral scales, in several specimens, bordered with the same. Fins blackish, especially the base of the caudal. From Cobessieontic Lake, in Kennebec Co., in Southwest Maine.

According to Commissioner Atkins, this species spawns immediately after the ice disappears, and instead of running into swift brooks, like the varieties of *O. viridescens*, hereinafter described, lays its eggs on the borders of meadows. The specimens described were taken in breeding condition at the breeding season.

As I owe the opportunity of describing these interesting *Osmeri* to my friend Dr. C. C. Abbott, I dedicate the present species to him.

Osmerus viridescens, Mitchill.

Osmerus sergeanti, Norris. Proceed. Acad. Nat. Sci. Phila., 1868, 93; loc. cit., 1861, March.

Two localities furnish specimens of land-locked smelt, which I can only distinguish from those of salt water by color. The first from Lake Mesalonskee, Kennebec Co., have a yellowish color on the sides, and black dorsal line, top of head, chin, and edges of lateral scales. The specimen is 14 inches long, said to be of medium size, therefore exceeding the average of the *O. viridescens* seen in Philadelphia market, and considerably larger than the *O. abbotti* and *O. spectrum*. They are called the Belgrade smelt.

Commissioner Atkins states that between the 10th and 20th of April, while the lakes are still covered with ice, this fish runs up into the brooks and lays its eggs by night, the eggs adhering to grass and stones. The spawning is complete always before the ice breaks up in the lakes. The temperature of the brooks is from 32° to 40° Fahr.

The second locality is Coehnewagn Pond, Kennebec Co. Specimens of "medium size" are smaller than the sea smelt from the mouth of the Kennebec, and larger than those of *O. abbottii*. They are generally similar to the last variety. These the notes state, breed later by 25 days than the last; that is, 12 or 15 days after the ice disappears, the temperature of the water being 43° to 45°.

The breeding season of the *O. abbottii* intervenes between those of the above varieties.

Commissioner Atkins says that the majority of the lakes of Maine contain smelt of some kind, and that he frequently finds smelt in the stomachs of trout from these lakes.

ANGUILLA, L.

Species not identified; very abundant in all the Atlantic waters of North Carolina (82).

GANOIDEA.

Lepidosteus osseus, L., occurs in the Yadkin and other eastern rivers of the State, and probably *L. huronensis* in the French Broad, as I have specimens of it from near Dandridge, E. Tennessee. *Polyodon folium* (*Spatularia*) ascends the same river to near Asheville, N. Ca. Various species of *Accipenser* abound in the Atlantic rivers, while descriptions of a fish called "Black fish" or "Brindle fish," found in the Neuse River, induce me to believe that *Amia* occurs there (83-7).

ON THE GEOGRAPHICAL DISTRIBUTION.

The table appended, shows readily, the characteristics of the faunæ of the four rivers of the State examined, though many species are no doubt omitted from each, certainly nearly all the larger ones, which I had not facilities for procuring.

The differences between the ichthyologies of the streams on opposite sides of the Allegheny shed, are rather greater in this State than in Virginia; the mountains here constituting a much more important topographical feature, both as to elevation and number of ranges.

The following points distinguish the two kinds of waters:

The western presents greater abundance of Percoids allied to *Etheostoma*, of *Uranidea*, and is the exclusive range of *Ambloplites*, *Micropterus fasciatus*, and *Polyodon*.

On the East, the Catawba and Yadkin are peculiar in their poverty in *Etheostomine* Perch, and the absence of the forms just named, while the extraordinary development of *Catostomidæ*, and abundance of *Amiurus*, *Anguilla*, and *Esox*, strike at once the naturalist who travels and collects from one to the other. The Neuse adds to these peculiarities a greater affinity to the more northern streams of Maryland and New Jersey, in the occurrence of *Enneacanthus*, *Aphredodirus*, *Moxostoma*, and *Hybopsis amarus*. Its pike and *Centrarchus* are of the South Carolina type.

After a similar investigation of the rivers heading on opposite sides of the Alleghenies of S. W. Virginia, I came to the following conclusions:

I. That after deducting species generally distributed, certain remain which occur in streams separated by high ranges of mountains.

II. That the distribution of species is not regulated by community or difference of outlet, rivers having diverse discharges having sometimes more in common than those having the same destination.

As regards the first, the present investigations are confirmatory. While nearly all the *Percidæ*, *Cyprinidæ*, and *Catostomidæ*, and all the *Siluridæ* of the French Broad River, differ from those of the East, we have the following common to both sides of the range:

Pæciliichthys flabellatus.

Micropterus nigricans.

Photogenis leucops.

Compstoma anomalum;

All species of pretty wide distribution. A peculiarity of distribution is

the occurrence of the *Photogenis leucops*, confined in Pennsylvania to the heads of the Ohio, and in Virginia to the Kanawha, not only in the Catawba, but in the Neuse. In further illustration, I append a list of species from the South Fork of the Cumberland, in the Cumberland Mountain region, near Kentucky.

<i>Micropterus fasciatus</i> .	<i>Semotilus corporalis</i> .
<i>Ambloplites rupestris</i> .	<i>Ceraticthys biguttatus</i> .
<i>Lepomis nitidus</i> .	<i>Hypsilepis cocogenis</i> .
<i>Percina caprodes</i> .	“ <i>galacturus</i> .
<i>Etheostoma blennioides</i> .	“ <i>ardens</i> .
<i>Pœciliichthys coeruleus</i> .	<i>Alburnellus micropteryx</i> .
“ <i>camurus</i> .	<i>Hybopsis longiceps</i> .
“ <i>sanguifluus</i> .	<i>Photogenis telescopus</i> .
<i>Hyostoma cymatogrammum</i> .	<i>Campostoma anomalum</i> .
“ <i>simoterum</i> .	
<i>Ptychostomus erythrus</i> .	
<i>Catostomus nigricans</i> .	

Twenty-one species.

Although separated from the waters of the French Broad by the highest ranges of the Cumberland Mountains, and flowing to the North, while the former flow to the South, there is no important difference between their fish inhabitants observable. The difference as compared with the case of the Catawba River, has reference in part to the difference in elevation of the mountain ranges separating them. Those of North Carolina rise to 6740 ft., while according to Prof. Safford, the highest point of the Cumberland is only 3000 feet.

Two curious points in the above list may be observed, viz: the occurrence of *Hypsilepis ardens*, and *Hybopsis longiceps*; species which I only found in the James and Roanoke in Virginia, and not in the Western waters, and which, while they occur in the Cumberland (the *H. longiceps* in the Clinch also) I did not find in the State of North Carolina!

Mimetic Analogy. A curious case of this occurred to me in three species of fishes which I took in a small tributary of the Yadkin River, in Roane Co., N. Ca. Among several others there were varieties of the widely distributed species, *Chænobryttus gillii*, *Hypsilepis analostanus*, and *Ptychostomus pidiensis*, (each representing a different family) which differ from the typical form of each in the same manner, viz: in having the back and upper part of the sides with longitudinal black lines, produced by a line along the middle of each scale. This peculiarity I have not observed in these species from any other locality. Until I had examined them I thought them new species.

The only other species presenting such marking in the Yadkin River, is the large perch, the *Roccus lineatus*. According to the theory of Natural Selection, a resemblance to this well-armed species might be of advantage to the much weaker species in question, yet the same species co-exist in other rivers without presenting the same mimicry.

<i>French Broad.</i>	<i>Cataba.</i>	<i>Yackin.</i>	<i>Neuse.</i>
<i>Stizostedion americanum</i> , salmonum.	<i>Etheostoma maculatum.</i>		<i>Perca flavescens.</i>
<i>Hypoholus aurantiacus.</i>			<i>Etheostoma nevisense.</i>
<i>Poeciliethys zonalis</i> , fiabellatus, vulneratus, rutilineatus.	<i>Poeciliethys fiabellatus</i> , var.		
<i>Hystoma cymatogrammum.</i>	<i>Boleosoma maculatiiceps.</i>	<i>Boleosoma maculatiiceps.</i>	<i>Poeciliethys vitreus.</i>
<i>Micropterus fasciatus</i> , nigricans.	<i>Micropterus nigricans.</i>	<i>Micropterus nigricans.</i>	<i>Boleosoma maculatiiceps.</i>
<i>Ambloplites rupestris.</i>			
<i>Lepomis megalotis</i> , notatus.	<i>Chaenobryttus gillii.</i>	<i>Chaenobryttus gillii.</i>	<i>Micropterus nigricans.</i>
<i>Amblodon.</i>	<i>Lepomis rubricauda.</i>	<i>Lepomis rubricauda.</i>	<i>Pomoxys hexacanthus.</i>
<i>Uranidea carolinæ.</i>	<i>Pomotis maculatus.</i>	<i>Lepomis purpurescens</i> <i>Pomotis maculatus.</i>	<i>Centrarchus irides.</i>
	<i>Esox affinis</i> , raveneli.		<i>Chaenobryttus gillii.</i>
<i>Salmo fontinalis.</i>	<i>Salmo fontinalis.</i>		<i>Lepomis rubricauda.</i>
<i>Semotilus corporalis.</i>	<i>Stilbe americana.</i>	<i>Stilbe americana.</i>	<i>Pomotis maculatus.</i>
<i>Ceraticethys biguttatus</i> , hyalinus.	<i>Semotilus corporalis.</i>	<i>Semotilus corporalis.</i>	<i>Aphredoderus sayanus.</i>
<i>Rhinichthys lunatus.</i>	<i>Ceraticethys biguttatus</i> , labrosus, hypsinotus.	<i>Ceraticethys biguttatus</i> , hypsinotus.	<i>Esox affinis</i> , raveneli.
<i>Hypsilepis coccigenis</i> , galacturus, cornutus, var.			<i>Stilbe americana.</i>
<i>Hypsopsis spectrunculus.</i>	<i>Hypsilepis analostanus.</i>	<i>Hypsilepis analostanus.</i>	<i>Semotilus corporalis.</i>
	<i>Hypsopsis amarus</i> , niveus, chlorocephalus.	<i>Hypsopsis chiliticus.</i>	<i>Ceraticethys biguttatus.</i>
			<i>Hypsilepis cornutus</i> , analostanus.
			<i>Hypsopsis ? amarus.</i>

Photogenis leucops, telescopus, leuciodus.	Photogenis leucops.	
? Alburnellus micropteryx.	Alburnellus altipinnis.	Alburnellus matutinus.
Campostoma anomalum.	Clinostomus affinis.	
Catostomus teres, nigricans.	Catostomus teres.	Catostomus teres.
	Ptychostomus cervinus.	Ptychostomus crassilabris, lachrymalis.
Ptychostomus erythrus.	robustus, thalassinus, coregonus, pidensis, collapsus, papillosus.	Ptychostomus collapsus.
Carpodes, sp.		
Ichthæurus œrulescens.		
Hopladelus olivaris.		
	Amiurus platycephalus.	Moxostoma oblongum.
	Noturus marginatus.	Amiurus niveiventer.
	Anguilla.	Anguilla,
Polyodon folium.	Accipenser.	Accipenser.
	Lepidosteus.	? Amia.
Lepidosteus huronensis.	Petromyzon.	Lepidosteus.
37 species.	35 species.	32 species.